GE Fanuc Automation
Programmable Control Products

TCP/IP Ethernet Communications

for Series 90™-30 CPU374 *PLUS*

User's Manual, GFK-2382

June 2005

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information contained herein does not purport to cover all details or variations in hardware or software, nor to provide for every possible contingency in connection with installation, operation, or maintenance. Features may be described herein which are not present in all hardware and software systems. GE Fanuc Automation assumes no obligation of notice to holders of this document with respect to changes subsequently made.

GE Fanuc Automation makes no representation or warranty, expressed, implied, or statutory with respect to, and assumes no responsibility for the accuracy, completeness, sufficiency, or usefulness of the information contained herein. No warranties of merchantability or fitness for purpose shall apply.

The following are trademarks of GE Fanuc Automation, Inc.

Alarm Master	Genius	ProLoop	Series Six
CIMPLICITY	Helpmate	PROMACRO	Series Three
CIMPLICITY 90–ADS	Logicmaster	PowerMotion	VersaMax
CIMSTAR	Modelmaster	PowerTRAC	VersaPoint
Field Control	Motion Mate	Series 90	VersaPro
GEnet	PACSystems	Series Five	VuMaster
	Proficy	Series One	Workmaster

©Copyright 2005 GE Fanuc Automation North America, Inc.
All Rights Reserved

Chapter 1 Introduction 1-1

Other Documents 1-2
Overview 1-3
Additional Ethernet Interfaces for the Series 90-30 PLC 1-3
CPU374 PLUS Ethernet Features 1-4
CPU374 PLUS Ethernet Interface Specifications 1-4
CPU374 PLUS Ethernet Interface Ports 1-5
Station Manager 1-5
Firmware Upgrades 1-6
Built-In Web Server 1-6
SRTP Client (Channels) 1-6
Ethernet Global Data (EGD) 1-6

Chapter 2 Installation and Startup 2-1

Module Appearance 2-2
Installing the CPU 374 PLUS in the PLC 2-3
Ethernet LEDs 2-4
LAN LED Operation 2-5
STAT LED Operation 2-5
EOK LED Operation 2-5
Ethernet Port Connectors 2-6
Embedded Switch 2-6
Connection to a 10Base-T / 100Base Tx Network 2-8
10Base-T/100Base Tx Port Pinouts 2-8
Station Manager Port 2-10
Port Settings 2-10
Port Pinout 2-10
Verifying Proper Powerup of the Ethernet Interface after Configuration 2-11
Pinging TCP/IP Ethernet Interfaces on the Network 2-12
Pinging the Ethernet Interface from a UNIX Host or Computer Running TCP/IP Software 2-12

Chapter 3 Configuration 3-1

Configuration Overview 3-2
Generating / Storing / Loading the Configuration 3-2
Backup Configuration Data 3-2
Locally-Edited Configuration Data 3-2
Initial IP Address Assignment 3-3
Assigning a Temporary IP Address Using the Programming Software 3-3
Assigning a Temporary IP Address Using BOOTP 3-5
Assigning a Temporary IP Address Using Telnet 3-6
Configuring the Ethernet Parameters of the CPU374 PLUS 3-7
CPU374 PLUS Ethernet Parameters 3-8

RS-232 Port (Station Manager) Parameters for the CPU374 PLUS 3-9
Configuring Ethernet Global Data 3-10
Installing the EGD Configuration Server 3-10
Enabling the Use of the EGD Configuration Server 3-11
Basic EGD Configuration 3-13
Installing the EGD Generic Device Editor 3-22

Chapter 4 Ethernet Global Data 4-1

Ethernet Global Data Operation 4-2
The EGD Producer 4-2
EGD Consumers 4-2
EGD Exchanges 4-3
The Content of an Ethernet Global Data Exchange 4-3
The Data Ranges (Variables) in an Ethernet Global Data Exchange 4-4
Valid PLC Memory Types for Ethernet Global Data 4-4
Planning Exchanges 4-5
Sending an Ethernet Global Data Exchange to Multiple Consumers 4-6
Multicasting Ethernet Global Data 4-6
Broadcasting Ethernet Global Data 4-7
Ethernet Global Data Timing 4-8
EGD Synchronization 4-8
Configurable Producer Period for an EGD Exchange 4-9
Consumer Update Timeout Period 4-9
Timestamping of Ethernet Global Data Exchanges 4-11
SNTP Operation 4-12
Effect of PLC Modes and Actions on EGD Operations 4-14
Monitoring Ethernet Global Data Exchange Status 4-15
Exchange Status Word Error Codes 4-16

Chapter 5 Programming EGD Commands 5-1

COMMREQ Format for Programming EGD Commands 5-2
COMMREQ Status for the EGD Commands 5-3
COMMREQ Status Values 5-3
Read PLC Memory (4000) 5-4
Read PLC Memory Command Block 5-4
Write PLC Memory (4001) 5-8
Write PLC Memory Command Block 5-8
Read EGD Exchange (4002) 5-11
Write EGD Exchange (4003) 5-14
Write EGD Exchange Command Block 5-14
Masked Write to EGD Exchange (4004) 5-17
Masked Write EGD Exchange Command Block 5-17
Masked Write to EGD Exchange Bit Mask and Data Bits 5-20

Chapter 6 Programming SRTP Channel Commands 6-1

SRTP Channel Commands 6-2
Channel Operations 6-2
Aborting and Re-tasking a Channel 6-2
Monitoring the Channel Status 6-3
Executing a Channel Command 6-5
COMMREQ Format for Programming Channel Commands 6-6
The COMMREQ Command Block: General Description 6-6
Establish Read Channel (2003) 6-9
Establish Write Channel (2004) 6-13
Send Information Report (2010) 6-17
Abort Channel (2001) 6-20
Retrieve Detailed Channel Status (2002) 6-21
Monitoring the Detailed Channel Status Words 6-23
Programming for Channel Commands 6-24
COMMREQ Example 6-24
Sequencing Communications Requests 6-27
Managing Channels and TCP Connections 6-27
Use “Channel Re-Tasking” To Avoid Using Up TCP Connections 6-28
Client Channels TCP Resource Management 6-29
SRTP Application Timeouts 6-29
Monitoring Channel Status 6-30
Format of the COMMREQ Status Word 6-30
New Features of SRTP Channels 6-31

Chapter 7 Network Administration 7-1

IP Addressing 7-2
IP Address Format for Network Classes A, B, C 7-2
IP Addresses Reserved for Private Networks 7-3
Multicast IP Addresses 7-3
Loopback IP Addresses 7-3
Gateways 7-4
Networks Connected by a Gateway 7-4
Subnets 7-5
Subnet Addressing and Subnet Masks 7-5
Example: Network Divided into Two Subnets 7-6

Chapter 8 PLC Monitoring Via the Web 8-1

System Requirements 8-1
Standard Web Pages 8-1
CPU374 PLUS Home Page 8-2
Reference Tables Viewer Page 8-3
Selecting Reference Table Data 8-3
PLC Fault Table Viewer Page 8-5

I/O Fault Table Viewer Page 8-7
Downloading PLC Web Pages 8-8
FTP Connect and Login 8-8
Changing the Password 8-9
Web Page File Transfer 8-10
Viewing the CPU374 PLC Web Pages 8-11

Chapter 9 Diagnostics 9-1

Diagnostic Tools Available for Troubleshooting 9-3
States of the Ethernet Interface 9-4
EOK LED Blink Codes for Hardware Failures 9-6
PLC Fault Table 9-7
PLC Fault Table Descriptions 9-8
Monitoring the Ethernet Interface Status Bits 9-10
Monitoring the FT Output of the COMMREQ Function Block. 9-12
Monitoring the COMMREQ Status Word 9-13
Major Error Codes in the COMMREQ Status Word 9-14
Minor Error Codes for Major Error Codes 05H (Remote Server) and 85H (Client) 9-15
Minor Error Codes for Major Error Code 11H (at Remote Server PLC) 9-17
Minor Error Codes for Major Error Code 90H (at Client PLC) 9-20
Minor Error Codes for Major Error Code A0H (at Client PLC) 9-22
Using the EGD Management Tool 9-23
Installing the EGD Management Tool 9-23
Launching the EGD Management Tool 9-23
Monitoring EGD Devices 9-24
Monitoring Status of Ethernet Global Data for a Device 9-25
Troubleshooting Common Ethernet Difficulties 9-29
COMMREQ Fault Errors 9-29
PLC Timeout Errors 9-30
Application Timeout Errors 9-31
EGD Configuration Mismatch Errors 9-32
Station Manager Lockout under Heavy Load 9-32
PING Restrictions 9-32
SRTP Connection Timeout 9-33
Sluggish Programmer Response after Network Disruption 9-33
EGD Command Session Conflicts 9-33
SRTP Request Incompatibility with SRTP Clients 9-34
COMMREQ Flooding Can Interrupt Normal Operation 9-34
Accelerated EGD Consumption Can Interfere with EGD Production 9-34

Appendix A Configuring Advanced User Parameters A-1

The AUP File A-2
Assigning an AUP File to the CPU374 PLUS A-3
Format of the Advanced User Parameters File A-4
Advanced User Parameter Definitions A-5

Chapter 1 Introduction

This manual describes the enhanced Ethernet features of Series 90-30 PLC CPU IC693CPU374 *PLUS* Release 12.0 and later CPUs. Earlier versions of the CPU374 utilize a different Ethernet Interface, which is described in the *TCP/IP Ethernet Communications for Series 90 PLCs User's Manual,* GFK-1541. Earlier versions of the CPU374 cannot be upgraded to provide these enhanced features.

Chapter 1, Introduction. This chapter includes basic information about the operation of the built-in enhanced CPU374 Ethernet interface.

Chapter 2, Installation describes user features and basic installation procedures.

Chapter 3, Configuration describes assigning a temporary IP address, configuring the CPU374 Release 12.0 or later Ethernet interface, configuring Ethernet Global Data, and setting up the RS-232 port for Local Station Manager operation.

Chapter 4, Ethernet Global Data describes basic Ethernet Global Data operation.

Chapter 5, EGD Commands describes a set of commands that can be used in the application program to read and write PLC data or Ethernet Global Data exchange data over the network.

Chapter 6, Programming SRTP Channel Commands describes how to implement PLC to PLC communications over the Ethernet network using SRTP Channel commands.

Chapter 7, Network Administration discusses how devices are identified on the network and how data is routed among devices.

Chapter 8, PLC Monitoring Via the Web describes the Web browser feature.

Chapter 9, Diagnostics describes diagnostic techniques. This chapter also lists COMMREQ Status codes.

Appendix A, Configuring Advanced User Parameters describes optional configuration of internal operating parameters used by the Ethernet interface. For most applications, the default Advanced User Parameters should not be changed.

Other Documents

- *TCP/IP Ethernet for Series 90-30 CPU374 PLUS, Station Manager Manual,* GFK-2383
- *Machine Edition Logic Developer-PLC Getting Started,* GFK-1918
- *Installation Requirements for Conformance to Standards,* GFK-1179
- *TCP/IP Communications for Series 90 PLCs User's Manual,* GFK-1541. Describes Ethernet communications for other Series 90 products, including earlier versions of the CPU374 with embedded Ethernet interface, and the Series 90-30 TCP/IP Ethernet Module, IC693CMM321.
- *TCP/IP Communications for Series 90 PLCs, Station Manager Manual,* GFK-1186. Describes the Station Manager function for other Series 90 PLC products, including earlier versions of the CPU374 with embedded Ethernet interface, and the Series 90-30 TCP/IP Ethernet Module, IC693CMM321.

The most recent system documentation is available online at www.gefanuc.com.

The *Infolink for PLC* CD set of documentation for GE Fanuc PLC products is updated periodically. It can be ordered as part number IC690CDR002.

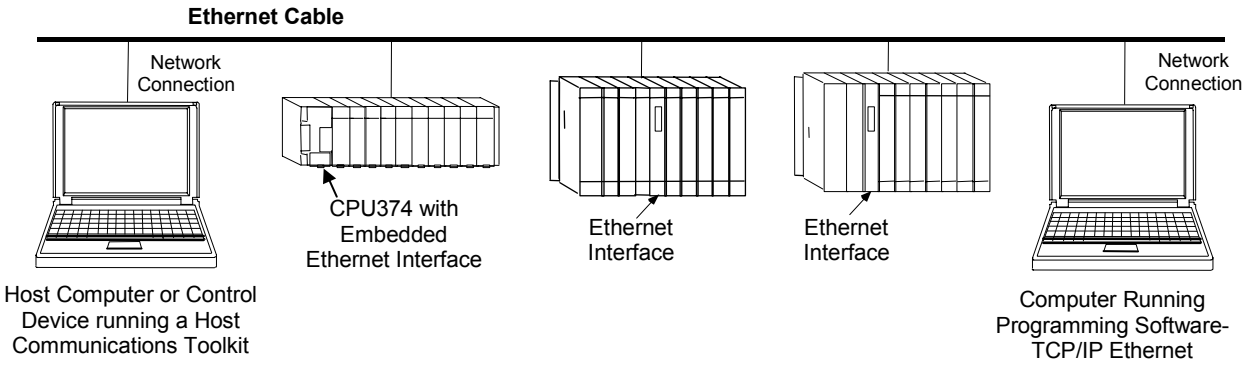
Overview

The built-in enhanced Ethernet interface of the Series 90-30 CPU374 PLUS provides TCP/IP communications with:

- Series 90, PACSystems, and VersaMax PLCs
- host computers running the Host Communications Toolkit or CIMPLICITY software
- computers running the TCP/IP version of the programming software.

These communications use the GE Fanuc SRTP and Ethernet Global Data (EGD) protocols over a four-layer TCP/IP (Internet) stack.

The Ethernet interface has SRTP server capability. As a *server,* the Ethernet Interface responds to requests from devices such as PLC programming software, a Host computer running an SRTP application, or another PLC acting as a client.



Additional Ethernet Interfaces for the Series 90-30 PLC

In addition to the embedded Ethernet interface in the CPU374 *PLUS*, up to three Series 90-30 Ethernet Modules (IC693CMM321) can be installed in the Series 90-30 PLC backplane.

If the PLC system includes any IC693CMM321 modules, please refer to the installation instructions, configuration, and communication details in the *TCP/IP Ethernet Communications for Series 90 PLCs User's Manual*, GFK-1541, and the *TCP/IP Ethernet Communications for Series 90 PLCs Station Manager Manual*, GFK-1186.

CPU374 PLUS Ethernet Features

- Full PLC programming and configuration services
- Periodic data exchange using Ethernet Global Data (EGD)
- EGD Commands to read and write PLC and EGD exchange memory over the network*
- TCP/IP communication services using SRTP
- Support for SRTP Client (Channels)*
- Basic remote PLC monitoring from a web browser*
- Comprehensive station management and diagnostic tools
- Extended PLC connectivity via IEEE 802.3 CSMA/CD 10Mbps and 100Mbps Ethernet LAN port connectors
- Network switch that has Auto negotiate, Sense, Speed, and crossover* detection
- Direct connection to BaseT (twisted pair) network switch, hub, or repeater without an external transceiver
- Protocol is stored in flash memory in the Ethernet interface and is easily upgraded through the CPU serial port
- Communications with remote PLCs and other nodes reachable through routers. The gateway IP address must be configured
- Internet access via web pages served up to standard web browsers*

* enhanced Ethernet feature not available prior to CPU374 *PLUS* (Release 12.00)

CPU374 PLUS Ethernet Interface Specifications

Ethernet processor speed	200 MHz
Connectors	- Station Manager (RS-232) Port: 9-pin female D-connector - Two 10BaseT / 100BaseTX Ports: 8-pin female shielded RJ-45
LAN	IEEE 802.2 Logical Link Control Class I IEEE 802.3 CSMA/CD Medium Access Control 10/100 Mbps
Number of IP addresses	One
Number of Ethernet Port Connectors	Two, both are 10BaseT / 100BaseTX with auto-sensing RJ-45 connection.
Embedded Ethernet Switch	Yes – Allows daisy chaining of Ethernet nodes.
Serial Port	Station Mgr Port: RS-232 DCE, 1200 - 115200 bps.
Programmer Compatibility	Use of the features described in this document requires Machine Edition Logic Developer software version 5.0, SP3, Logic Developer PLC HotFix 3. Note that the VersaPro programming software could be used for configuration, however, VersaPro supports only Release 11.0 features, even in a Release 12.0 or later CPU374.

CPU374 PLUS Ethernet Interface Ports

The embedded Ethernet interface of a CPU374 *PLUS* provides two auto-sensing 10Base T / 100Base TX RJ-45 shielded twisted pair Ethernet ports for connection to either a 10BaseT or 100BaseTX IEEE 802.3 network.

Each port automatically senses the speed (10Mbps or 100Mbps), duplex mode (half duplex or full duplex) and cable (straight-through or crossover) attached to it with no intervention required.

Ethernet Media

The Ethernet interface can operate directly on 10BaseT/100BaseTX media via its network ports.

10BaseT: 10BaseT uses a twisted pair cable of up to 100 meters in length between each node and a switch, hub, or repeater. Typical switches, hubs, or repeaters support 6 to 12 nodes connected in a star wiring topology.

100BaseTX: 100BaseTX uses a cable of up to 100 meters in length between each node and a switch, hub, or repeater. The cable should be data grade Category 5 unshielded twisted pair (UTP) or shielded twisted pair (STP) cable. Two pairs of wire are used, one for transmission, and the other for collision detection and receive. Typical switches, hubs, or repeaters support 6 to 12 nodes connected in a star wiring topology.

Station Manager

The built-in Station Manager function provides on-line supervisory access to the Ethernet interface, through the Station Manager port or over the Ethernet cable. Station Manager services include:

- An interactive set of commands for interrogating and controlling the station.
- Unrestricted access to observe internal statistics, an exception log, and configuration parameters.
- Password security for commands that change station parameters or operation.

For remote Station Manager operation over the Ethernet network, the Ethernet interface uses IP addressing. The Ethernet interface cannot send or receive remote Station Manager messages that are sent to a MAC address.

Refer to the *TCP/IP Ethernet Communications for Series 90-30 CPU374 PLUS Station Manager Manual*, GFK-2383 for complete information on the Station Manager functions of a CPU374 PLUS.

Firmware Upgrades

The embedded Ethernet interface firmware of a CPU374 *PLUS* is upgraded using the WinLoader software utility, along with the rest of the CPU firmware. WinLoader seamlessly upgrades first the CPU firmware and then the embedded Ethernet firmware without intervention. Any additional Ethernet Interface module in the PLC can have its firmware explicitly upgraded by specifying the rack and slot location of the module to the WinLoader utility.

Built-In Web Server

The enhanced Ethernet interface of a CPU374 *PLUS* provides built-in Web Server capability. Web pages can be stored and maintained on the Ethernet interface and served up via the web to standard web browsers. A basic set of predefined web pages in English is provided; they include a home page, Reference Table data, PLC Fault Table, and I/O Fault Table. Pages can be stored to the Ethernet interface via FTP.

SRTP Client (Channels)

SRTP channels can be set up in the PLC application program. SRTP supports COMMREQ-driven channel commands to establish new channels, abort existing channels, and retrieve the status of an existing channel.

The enhanced CPU374 *PLUS* Ethernet interface simultaneously supports up to 16 SRTP Client (Channel) connections and 20 SRTP Server connections. SRTP Client allows the Ethernet interface to initiate data transfer with other SRTP-capable devices on the network.

Ethernet Global Data (EGD)

The CPU374 *PLUS* enhanced Ethernet interface supports up to 128 simultaneous Ethernet Global Data (EGD) exchanges. EGD exchanges are configured using the programmer and stored into the PLC. Both Produced and Consumed exchanges can be configured. The CPU374 Ethernet interface supports both selective consumption of EGD exchanges and EGD exchange production and consumption to the broadcast IP address of the local subnet.

The Ethernet interface can be configured to use SNTP to synchronize the timestamps of produced EGD exchanges.

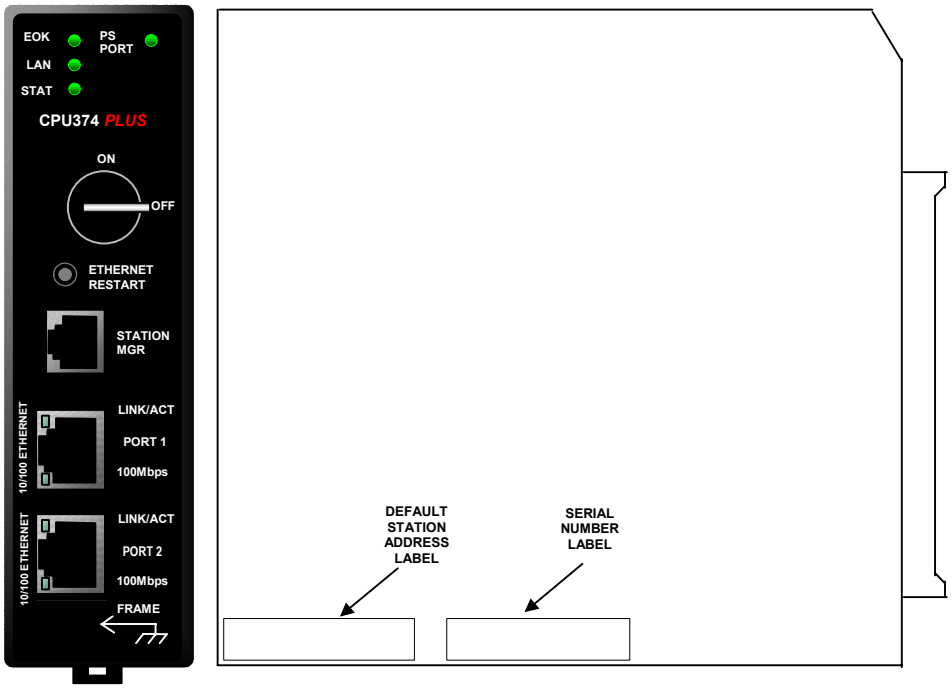
The CPU374 *PLUS* enhanced Ethernet interface implements the capabilities of a Class 1 and Class 2 device. COMMREQ-driven EGD Commands can be used in the application program to read and write data into EGD Class 2 devices.

Chapter 2 Installation and Startup

This chapter describes the CPU374 *PLUS* Ethernet interface user features and basic installation procedures:

- Module Appearance
- Installing the CPU374 *PLUS* in the PLC
- Ethernet LEDs
- Ethernet Port Connectors
  - Embedded Switch
  - Connection to a 10Base T / 100Base Tx Network
- Station Manager Port
- Verifying Proper Powerup of the Ethernet Interface After Configuration
- Pinging TCP/IP Ethernet Interfaces on the Network

Module Appearance



The front of the CPU374 *PLUS* module has eight LEDs, an On/Off switch, an Ethernet Restart pushbutton, a connector for the Station Manager function, and two Ethernet port connectors.

The Ethernet Restart pushbutton is used to manually restart the Ethernet firmware without power cycling the entire system. It is recessed to prevent accidental operation.

The PS (Power Supply) PORT LED is not Ethernet-related; it indicates the presence of serial traffic through the serial port of the PLC's power supply.

Each of the three Ethernet LEDs (EOK, LAN, and STAT) can be ON, OFF, BLINKING slow, or BLINKING fast. These LEDs indicate the state of the Ethernet interface, traffic at the Ethernet Interface (LAN LED), and the occurrence of exception events.

Each of the two Ethernet ports has two LEDs, **100** and **LINK**. The **100** LED indicates the network data speed (10 or 100 Mb/sec). This LED is lit if the network connection at that network port is 100 Mbps. The **LINK** LED indicates the network link status and activity. This LED is lit when the link is physically connected. It blinks when traffic is detected at that network port. Traffic at the port does not necessarily mean that traffic is present at the Ethernet interface, since the traffic may be going between ports of the switch.

The default station address (MAC address) label is located on the outside of the module as shown above. Record the number on this label before installing the module.

Installing the CPU 374 PLUS in the PLC

For general information about module and system installation, refer to GFK-0356, *Series 90-30 Programmable Controller Installation Manual*.

1. Be sure the Series 90-30 PLC baseplate power is OFF.

Warning

Do not insert or remove modules with power applied. This could cause the PLC to Stop, damage the module, or result in personal injury.

2. Align the module with the CPU's base slot (slot 1) and connector. Tilt the module upwards so that the top rear hook of the module engages the slot on baseplate.
2. Swing the module downward until the connectors mate and the lock-lever on the bottom of the module snaps into place engaging the baseplate notch.
3. Visually inspect the module to be sure that it is properly seated.
4. Connect one or both of the Ethernet ports on the Ethernet interface to the network.
5. Restore power to the baseplate.
6. Use the PLC programming software to make sure the PLC CPU is in Stop mode.

Ethernet LEDs

The **EOK**, **LAN**, and **STAT** LEDs indicate the state and status of the Ethernet interface.

LED State (● On ✱ Blinking ○ Off)			Indicates
✱ ○ ○	EOK LAN STAT	Fast Blink Off Off	Performing Diagnostics
✱ ○ ○	EOK LAN STAT	Slow Blink Off Off	Waiting for Ethernet configuration from CPU
✱ ●✱○ ✱	EOK LAN STAT (* *EOK and STAT blink in unison*)	Slow Blink* On/Traffic/Off Slow Blink*	Waiting for IP Address
● ●✱○ ●○	EOK LAN STAT	On On/Traffic/Off On/Off	Operational
✱ ○ ○	EOK LAN STAT	Blink error code Off Off	Hardware failure.
✱ ✱ ✱	EOK LAN STAT (* *All LEDs blink in unison; pattern same for awaiting or performing load*)	Slow Blink* Slow Blink* Slow Blink*	Software Load

LED Operation during Restart

When the Ethernet firmware is manually restarted by the Ethernet pushbutton in any state, the EOK, LAN and STAT LEDs are briefly turned on in unison as an LED test. These three LEDs are turned on for ½ second and are then turned off when the firmware is restarted. The Ethernet port LEDs are not affected by a manual restart of the Ethernet firmware.

The LED test is performed only upon a manual pushbutton restart; there is no LED test when the Station Manager initiates a restart.

LAN LED Operation

The LAN LED indicates access to the Ethernet network. During normal operation and while waiting for an IP address, the LAN LED blinks when data is being sent or received over the network directed to or from the Ethernet interface. It remains on when the Ethernet interface is not actively accessing the network but the Ethernet physical interface is available and one or both of the Ethernet ports is operational.

It is off otherwise unless software load is occurring.

STAT LED Operation

The STAT LED indicates the condition of the Ethernet interface in normal operational mode. If the STAT LED is off, an event has been entered into the exception log and is available for viewing via the Station Manager. The STAT LED is on during normal operation when no events are logged.

In the other states, the STAT LED is either off or blinking and helps define the operational state of the module.

EOK LED Operation

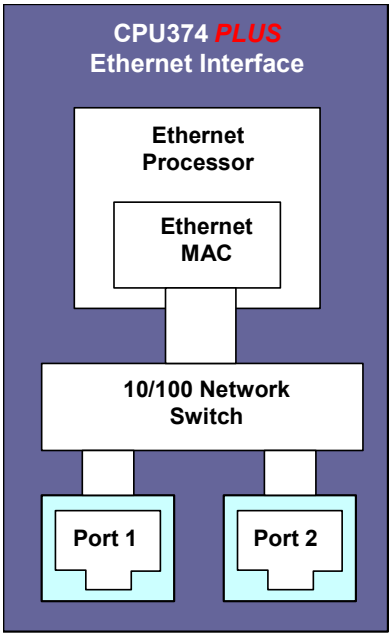
The EOK LED indicates whether the Ethernet interface is able to perform normal operation. This LED is on for normal operation and flashing for all other operations. When a hardware or unrecoverable runtime failure occurs, the EOK LED blinks a two-digit error code identifying the failure.

Ethernet Port Connectors

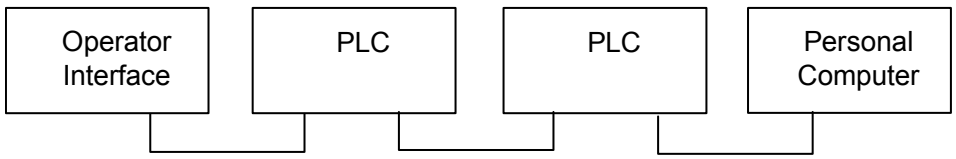
The Ethernet interface on the CPU374 *PLUS* includes two Ethernet port connectors, each of which supports both 10Base-T and 100Base-Tx operation using either full duplex or half duplex operation. These 8-pin RJ-45 connectors are used to connect the Ethernet Interface to a hub, repeater, switch, or other Ethernet device.

Embedded Switch

The two Ethernet port connectors are controlled by an embedded network switch in the module. The module has only one interface to the network (one Ethernet address and one IP address).



For simple installations, the embedded switch allows devices to be connected without additional components.



It is possible to daisy-chain PLCs together without additional components, but that should be done with great care. Power loss or reset at an Ethernet interface causes loss of communication to any devices downstream from that Ethernet interface in the daisy chain. Restarting the Ethernet interface (via the Ethernet Restart pushbutton, for example) disrupts daisy chain communication.

Each switch port auto-negotiates (by default) to the correct link speed and duplex mode for the device connected to the other end of the link. Each port operates independently, so devices at two different speeds and/or duplex modes may be attached to the two ports. Each port also automatically detects the attached cable and will work properly with either straight-through or crossover cables (by default).

Caution

The two Ethernet ports on the Ethernet interface must not be connected, directly or indirectly, to the same device. The connections in an Ethernet network based on twisted pair cabling must form a tree and not a ring, otherwise duplication of packets and network overload may occur.

Caution

The IEEE 802.3 standard strongly discourages the manual configuration of duplex mode for a port (as would be possible using Advanced User Parameters). Before manually configuring duplex mode for an Ethernet Interface port using advanced user parameters (AUP), be sure that you know the characteristics of the link partner and are aware of the consequences of your selection. Setting both the speed and duplex AUPs on an IC698 Ethernet Interface port will disable the port's auto-negotiation function. If its link partner is not similarly manually configured, this can result in the link partner concluding an incorrect duplex mode. In the words of the IEEE standard: "Connecting incompatible DTE/MAU combinations such as full duplex mode DTE to a half duplex mode MAU, or a full-duplex station (DTE or MAU) to a repeater or other half duplex network, can lead to severe network performance degradation, increased collisions, late collisions, CRC errors, and undetected data corruption."

Note: If both speed and duplex mode of an Ethernet interface port are forced using the Advanced User Parameters file, that port will no longer perform automatic cable detection. This means that if you have the Ethernet interface port connected to an external switch or hub port you must use a crossover cable. If you have the Ethernet interface port connected to the uplink port on an external switch or hub, or if you have the Ethernet interface port directly connected to another Ethernet device, you must use a normal cable.

Connection to a 10Base-T / 100Base Tx Network

Either shielded or unshielded twisted pair cable may be attached to a port. The 10Base-T/100Base Tx twisted pair cables must meet the applicable IEEE 802 standards. Category 5 cable is required for 100BaseTX operation.

Each Ethernet port automatically senses whether it is connected to a 10BaseT or 100BaseTX network, half-duplex or full-duplex. (The automatic negotiation of speed and/or duplex mode can be explicitly overridden using Advanced User Parameter settings).

10Base-T/100Base Tx Port Pinouts

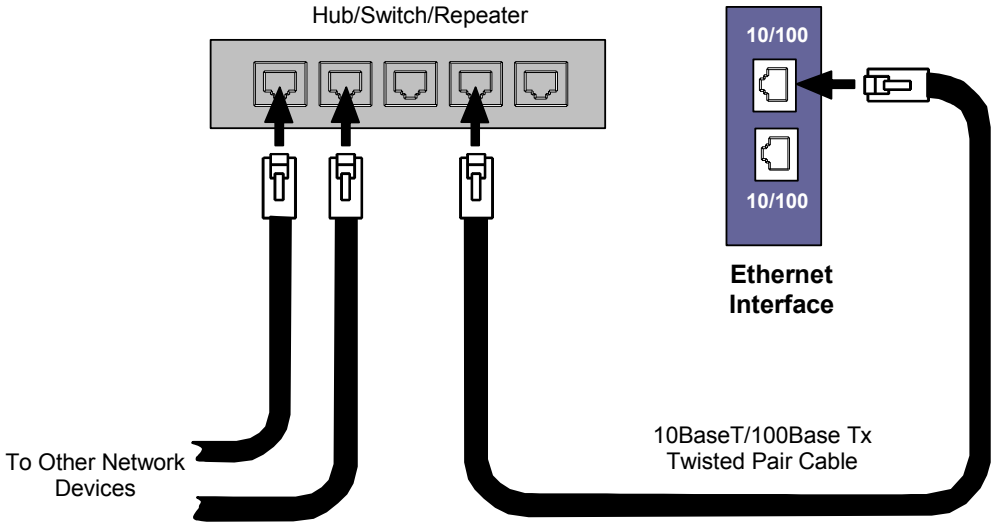
Pin Number	*Signal*	*Description*
1*	TD+	Transmit Data +
2	TD–	Transmit Data –
3	RD+	Receive Data +
4	NC	No connection
5	NC	No connection
6	RD–	Receive Data –
7	NC	No connection
8	NC	No connection

* Pin 1 is at the bottom of the Ethernet port connector as viewed from the front of the module.

Note: Pinouts are provided for troubleshooting purposes only. 10Base-T/100Base-Tx cables are readily available from commercial distributors. GE Fanuc recommends purchasing rather than making 10Base-T/100Base-Tx cables.

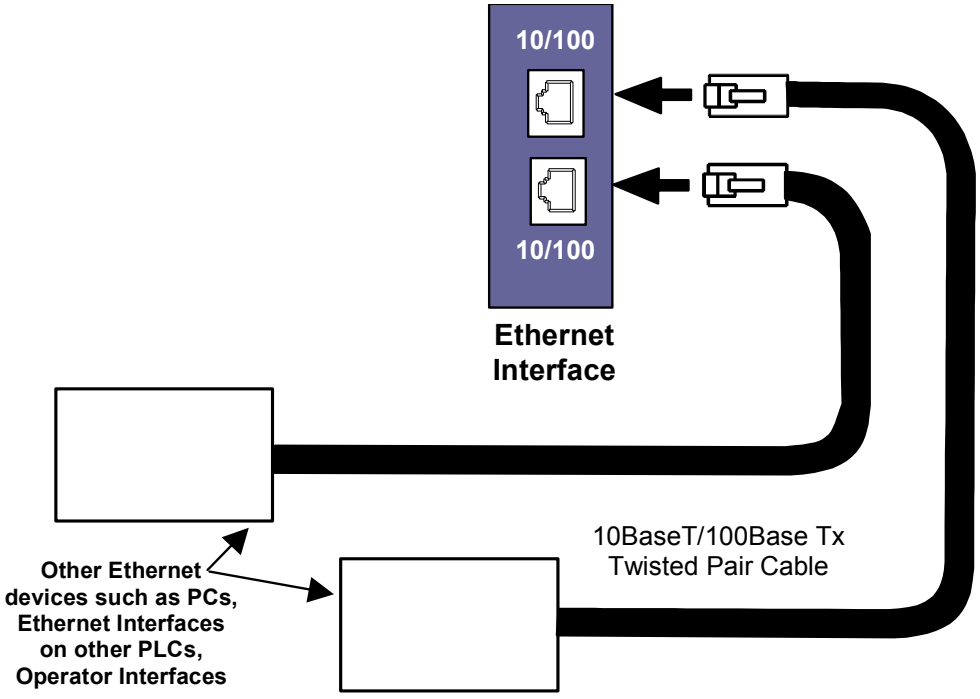
Connection Using a Hub/Switch/Repeater

Connection of the Ethernet Interface to a 10Base-T or 100Base-Tx network is shown below.



Direct Connection to the CPU374 PLUS Ethernet Interface

Connection of Ethernet devices directly to the CPU374 *PLUS* Ethernet interface is shown below:



Station Manager Port

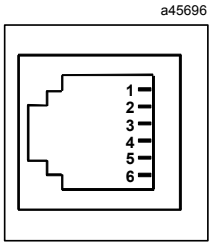
The RS-232, 6-pin, RJ-11 port is used to connect a terminal or terminal emulator to access the Station Manager software on the Ethernet interface. A cable is needed to connect the terminal, emulator, or Software Loader to the Ethernet interface.

Port Settings

The serial (COM) port of the terminal or computer that is connected to the Ethernet interface must use the same communications parameters as the Ethernet interface.

The default values for the Station Manager port are 9600 bps, 8 bits, no parity, and 1 stop bit. If the Ethernet interface is configured with default values for this port, or the Ethernet interface has not been configured, use these default values. If the Ethernet interface is configured with non-default values for this port, use those values for the serial port settings of the terminal or computer.

Port Pinout



Station Manager Serial Port Pinout

RJ-11 Port Pin Number	*Signal*	*Description*
1	CTS	Clear To Send (input)
2	TD	Transmit Data (output)
3	SG	Signal Ground
4	SG	Signal Ground
5	RD	Receive Data (input)
6	RTS	Request to Send (output)

Verifying Proper Powerup of the Ethernet Interface after Configuration

After configuring the Ethernet interface as described in the next chapter, turn power OFF to the CPU for 3–5 seconds, then turn the power back ON. This starts a series of diagnostic tests. The EOK LED will blink indicating the progress of power-up.

The Ethernet LEDs will have the following pattern upon successful power-up. At this time the Ethernet interface is fully operational and on-line.

LED	Ethernet Interface Online	
EOK		On
LAN		On, Off, or blinking, depending on network activity
STAT		On

If a problem is detected during power-up, the Ethernet interface may not transition directly to the operational state. If the Interface does not transition to operational, refer to “Diagnostics,” chapter 9, for corrective action.

Pinging TCP/IP Ethernet Interfaces on the Network

PING (Packet InterNet Grouper) is the name of a program used on TCP/IP networks to test the ability to reach a destination by sending it an ICMP echo request message and waiting for a reply. Most nodes on TCP/IP networks implement a PING command.

You should ping each installed Ethernet interface. When the Ethernet interface responds to the ping, it means acceptable TCP/IP configuration information has been downloaded to the Interface. The interface is operational and configured properly.

Pinging the Ethernet Interface from a UNIX Host or Computer Running TCP/IP Software

A *ping* command can be executed from a UNIX host or computer running TCP/IP (most TCP/IP communications software provides a *ping* command) or from another Ethernet interface. When using a computer or UNIX host, you can refer to the documentation for the *ping* command, but in general all that is required is the IP address of the remote host as a parameter to the *ping* command. For example, at the command prompt type:

```
ping  10.0.0.1
```

Determining if an IP Address is Already Being Used

Note: This method does not guarantee that an IP address is not duplicated. It will not detect a device that is configured with the same IP address if it is temporarily off the network.

It is very important not to duplicate IP addresses. To determine if another node on the network is using the same IP address:

1. Disconnect your Ethernet interface from the LAN.
2. Ping the disconnected interface's IP address. If you get an answer to the ping, the chosen IP address is already in use by another node. You *must* correct this situation by assigning unique IP addresses.

Chapter 3 Configuration

Before you can use the Ethernet interface features of the Series 90-30 CPU374 *PLUS*, you must configure the CPU using Machine Edition Logic Developer-PLC software. The configuration process for a CPU374 *PLUS* embedded Ethernet interface includes:

- Assigning a temporary IP address for initial network operation, such as connecting the programmer in order to download the hardware configuration.
- Configuring the characteristics of the Ethernet interface.
- Configuring Ethernet Global Data (if used).
- (Optional, not required for most systems). Setting up the RS-232 port for Local Station Manager operation.
- (Optional, not required for most systems). Configuring advanced parameters. This requires creating a separate ASCII parameter file that is stored to the PLC with the hardware configuration. The Ethernet Interface has a set of default Advanced User Parameter values that should only be changed in exceptional circumstances by experienced users. The Advanced User Parameters definitions and configuration are described in appendix A.
- If the Series 90-30 PLC also includes Ethernet Interface Modules (IC693CMM321), they must be included in the overall system configuration. CMM321 modules are described in the *TCP/IP Ethernet Communications for Series 90 PLCs User's Manua*l, GFK-1541. Information about overall system configuration is available in other Series 90-30 PLC documentation and in the Logic Developer online help.

Configuration Overview

A CPU374 *PLUS* can be configured with the Machine Edition PLC Logic Developer-PLC programmer Release 5.00 SP3 Hot Fix 3 or later. It could also be configured using VersaPro, but the CPU's enhanced features would not be available. VersaPro is only able to configure the CPU with the properties of a Release 11.0 CPU374.

The programmer can be connected via the serial port on the PLC power supply, or over the Ethernet network. For initial network programmer connection, an initial IP address must be manually assigned to the Ethernet interface as described next in this chapter. The CPU374 *PLUS* does not support autoconfiguration.

Generating / Storing / Loading the Configuration

The Series 90-30 CPU374 *PLUS* Ethernet interface uses several types of configuration data: Ethernet Configuration, optional Ethernet Global Data Configuration, and optional Advanced User Parameter (AUP) Configuration. All of these configuration parameters are generated at the programmer and stored from the programmer to the CPU as part of the hardware configuration Store sequence. Configuration parameters may be loaded from the CPU into the programmer as part of the Configuration Load sequence. An optional AUP file may be generated with a text editor and then imported into the programmer. The programmer stores any AUP files to the PLC within the Configuration Store operation. Once stored to the PLC, the CPU maintains the configuration data over power cycles.

Run Mode Store is not permitted for Ethernet Global Data configuration data.

Backup Configuration Data

The CPU37 *PLUS* enhanced Ethernet interface saves a backup copy of the most recent Ethernet Configuration and AUP Configuration in non-volatile memory for use when the PLC is cleared. (Ethernet Global Data configuration is maintained only in the CPU.)

Locally-Edited Configuration Data

If the PLC configuration was not stored from the programmer, the CHSOSW and CHPARM Station Manager commands can be used to locally-edit Ethernet configuration or AUP configuration data. These Station Manager commands are not active if the PLC configuration has been stored from the programmer.

Locally-edited configuration changes cannot be retrieved into the PLC and loaded to the programmer. Locally-edited configuration changes are always overwritten when a PLC configuration is stored into the PLC from the programmer.

Initial IP Address Assignment

The Series 90-30 CPU374 *PLUS* comes from the factory with a default IP address (0.0.0.0) for its embedded Ethernet interface. This default address is not valid on any Ethernet network, so an initial IP address must be assigned for initial network operation such as connecting the programmer to download the first hardware configuration. The initial IP address must be selected for proper operation with your network and application; see your network administrator for the proper initial IP address value.

One way to assign the initial IP address is via the CHSOSW command from a local serially-connected Station Manager terminal. See the *TCP/IP Ethernet Communications for Series 90-30 CPU374 PLUS Station Manager Manual,* GFK-2383, for details.

Alternatively, if the PLC is not in a RUN state an IP address can be set using the "Set IP" method. That method can be used even if the module already has a valid configured IP Address. If the module has the factory default IP Address 0.0.0.0, a temporary IP address can be set using BOOTP over the Ethernet network, if a BOOTP server is present. Both temporary IP address assignment methods are described here.

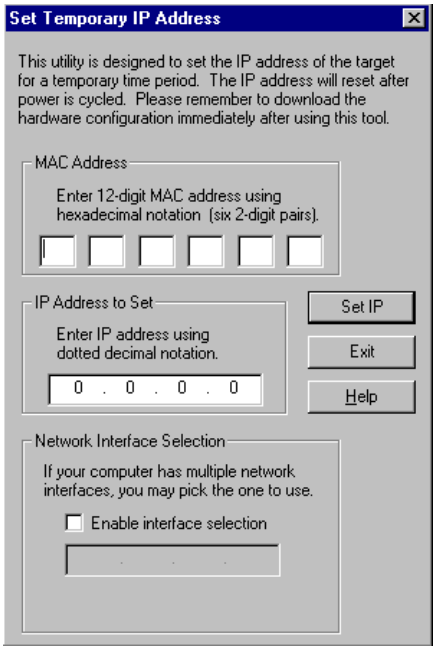
Assigning a Temporary IP Address Using the Programming Software

To initiate Ethernet communications with the programmer, you first need to set up a temporary IP address. After the programmer is connected, the actual IP address for the Ethernet interface (set up in the hardware configuration) should be downloaded to the PLC. The temporary IP address remains in effect until the Ethernet interface is restarted or power-cycled, or until the hardware configuration is downloaded or cleared.

- To use the Set Temporary IP Address utility, the PLC CPU must not be in RUN mode. IP address assignment over the network is not processed until the CPU is stopped and is not scanning outputs.
- The current user logged on to the PC running the Set Temporary IP Address utility must have full administrator privileges.
- The Set Temporary IP Address utility can be used if communications with the networked CPU374 *PLUS* target travel across network switches and hubs. However, that does not work if communications travel through a router.
- The target must be located on the same sub-network (subnet) as the computer running the Set Temporary IP Address utility. The sub-network is specified by the computer's subnet mask and the IP addresses of the computer and the CPU374 *PLUS* enhanced Ethernet interface.

To set the IP address, you need the MAC address of the Ethernet interface. The MAC address is located on a label on the module, as shown in chapter 2, Installation. Connect the Series 90-30 CPU374 *PLUS* to the Ethernet network.

1. In the Project tab of the Navigator, right-click the CPU374 *PLUS* target. Choose Offline Commands, then Set Temporary IP Address. The Set Temporary IP Address dialog box appears.


Set Temporary IP Address
This utility is designed to set the IP address of the target for a temporary time period. The IP address will reset after power is cycled. Please remember to download the hardware configuration immediately after using this tool.
MAC Address
Enter 12-digit MAC address using hexadecimal notation (six 2-digit pairs).
IP Address to Set
Enter IP address using dotted decimal notation.
0 . 0 . 0 . 0
Set IP
Exit
Help
Network Interface Selection
If your computer has multiple network interfaces, you may pick the one to use.
Enable interface selection

2. In the Set Temporary IP Address dialog box, do the following:

   - Specify the MAC address of the Ethernet interface.
   - In the IP Address to Set box, specify the temporary IP address you want to assign to the Ethernet interface.
   - If the system has multiple Ethernet network interface modules, select the Enable Network Interface Selection check box and specify the network interface being set up.

3. When the fields are properly configured, click the Set IP button.
4. The Set Temporary IP Address utility verifies that the specified IP address is not already in use, then it sets the selected Ethernet interface to the specified IP address. Finally, the utility verifies that the Ethernet interface responds at the selected IP address. Successful completion, or an error that occurs during address assignment is reported. These operations may take up to a minute.

Cautions

The temporary IP address set by the Set Temporary IP Address utility is not retained through a power cycle. To set a permanent IP Address, you must set configure the target's IP Address and download the hardware configuration to the target.

The Set Temporary IP Address utility can assign a temporary IP address even if the target Ethernet interface has previously been configured to a non-default IP address. (This includes overriding an IP address previously configured by the programmer.)

Use this IP Address assignment mechanism with care.

Assigning a Temporary IP Address Using BOOTP

When the Series 90-30 CPU374 *PLUS* Ethernet interface receives the default IP address (0.0.0.0), either from hardware configuration or from internal backup configuration, it attempts to obtain a temporary IP address from a BOOTP server on the Ethernet network. The Ethernet interface acts as a BOOTP client. The Ethernet interface issues a BOOT Request to the network. If any BOOTP server on the network recognizes the Ethernet interface, that server will return a BOOT Reply containing an IP address (and optionally a subnet mask and gateway IP address) to the requesting Ethernet interface.

Typically, the BOOTP server must be manually configured with the MAC address and IP address (and possibly other information such as subnet mask and gateway) for each supported client device. Each supported client must be identified by its globally unique MAC address. The Ethernet interface 's MAC address is specified on its MAC Address Label as described in chapter 2, Installation.

The BOOTP server must not be separated from the CPU374 *PLUS* by a router. BOOTP uses broadcast messages, which typically do not pass through routers. Consult your network administrator for more details.

Caution

The temporary IP address set by BOOTP is not retained through a power cycle. To set a permanent IP Address, you must configure the Ethernet interface's IP Address at the programmer and download the hardware configuration to the PLC.

Assigning a Temporary IP Address Using Telnet

The temporary IP address assignment performed by the programmer's Set Temporary IP Address utility can also be performed manually from a computer's DOS command window if the programming software is not available. This method uses an attempted Telnet connection to transfer the IP address, even though the CPU374 *PLUS* enhanced Ethernet interface does not support normal Telnet operation.

Caution

The Telnet method can assign a temporary IP address whether or not the Ethernet interface already has in IP address, even if the Ethernet interface has been previously configured to a non-default IP address. (This includes overriding an IP address previously configured by the programming software.)

Use this IP Address assignment mechanism with care.

To temporarily set the IP address over the network, the PLC CPU must not be running. IP address assignment over the network will not be processed until the CPU is stopped and is not scanning outputs.

1. Obtain the Ethernet interface's MAC address from its MAC Address Label as shown in chapter 2, Installation.
2. On the computer, open a standard DOS command window. Associate the desired IP address for the Ethernet interface with the MAC address of the Ethernet interface. In the DOS command window, enter:

   ```
   > ARP –s ip_address mac_address
   ```

   for *ip_address,* enter the IP address being assigned to the Ethernet interface, and for *mac_address,* enter the MAC address of the Ethernet interface.
3. Issue a Telnet command to the IP address (*ip_address*) being assigned to the Ethernet interface via the following command:

   ```
   > telnet ip_address 1
   ```

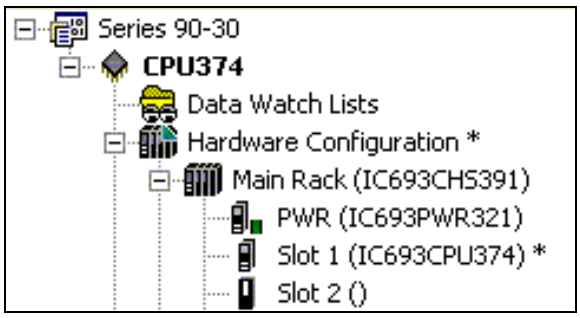
   (This command is always sent to port 1.) This Telnet command will fail, but the IP address provided with the Telnet command will be passed to the Ethernet interface and will be temporarily activated.

The IP address assigned over the network remains in effect until the Ethernet interface is restarted or power-cycled, or until the configuration is downloaded or cleared. Once connected, the intended IP address should be permanently downloaded to the Ethernet interface via the hardware configuration.

Configuring the Ethernet Parameters of the CPU374 PLUS

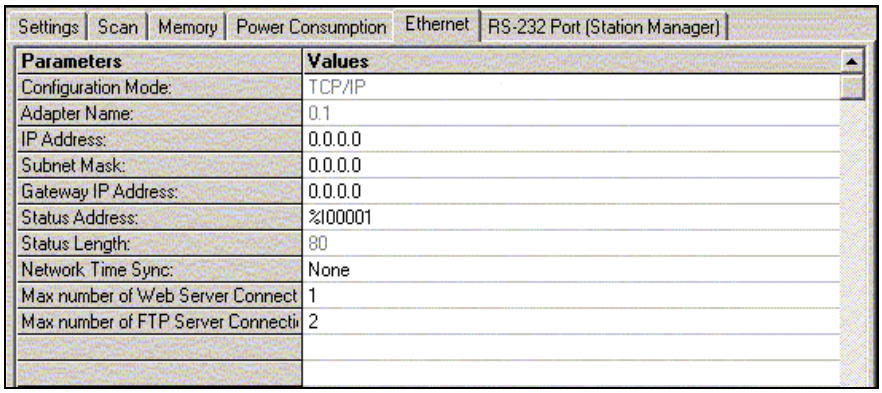
This section describes how to configure the Ethernet parameters of a Series 90-30 CPU374 *PLUS* enhanced Ethernet interface.

In the Project tab of the Navigator, expand the desired Series 90-30 PLC Target, the hardware configuration, and the main rack (Rack 0).



Right-click on the desired target (CPU374, as in this example; the designation CPU374 *PLUS* does not appear in the programmer) and select Properties. Ethernet parameters can be configured on the Ethernet tab and on the RS-232 Port (Station Manager) tab. Configuration of the other CPU parameters is not described here.

CPU374 PLUS Ethernet Parameters



Configuration Mode: This is fixed as TCP/IP.

Adapter Name: This is automatically generated based upon the rack/slot location of the Ethernet interface (0.1).

IP Address, Subnet Mask, Gateway IP Address: These values should be assigned by the person in charge of your network (the network administrator). TCP/IP network administrators are familiar with these parameters. It is important that these parameters are correct, otherwise the Ethernet interface may be unable to communicate on the network and/or network operation may be corrupted. It is especially important that each node on the network is assigned a *unique* IP address.

If you have no network administrator and are using a simple *isolated network* with no gateways, you can use the following range of values for the assignment of local IP addresses:

10.0.0.1	First Ethernet interface
10.0.0.2	Second Ethernet interface
.	.
.	.
.	.
10.0.0.255	Programmer TCP or host

Also, in this case, set the subnet mask, and gateway IP address to 0.0.0.0.

Note: If the isolated network is connected to another network, the IP addresses 10.0.0.1 through 10.0.0.255 must not be used, and the subnet mask and gateway IP address must be assigned by the network administrator. The IP addresses must be assigned so that they are compatible with the connected network.

Status Address: The Status Address is the reference memory location for the Ethernet interface status data. The Ethernet interface will automatically maintain 16 LAN Interface Status (LIS) bits in this location and 64 Channel Status bits in this location for a total of 80 bits. The Status address can be assigned to valid %I, %Q, %R, %AI, or %AQ memory. The default value is the next available %I address. See chapter 9, Diagnostics, for definitions of the LAN Interface Status (LIS) portion of the Ethernet Status data.

The meaning of the Channel Status portion of the Ethernet Status depends upon the type of operation for each channel. See chapter 6 for the meaning of the Channel Status bits for SRTP channels operation.

> **Note:** Do not use the 80 bits configured as Ethernet Status data for other purposes or data will be overwritten.

Status Length: This is the total length of the Ethernet interface status data. This is automatically set to either 80 bits (for %I and %Q Status address locations) or 5 words (for %R, %AI, and %AQ Status address locations).

Network Time Sync: The method used to synchronize the real-time clocks over the network. The choices are None (for no network time synchronization) and SNTP (for synchronization to remote SNTP servers on the network). See “Simple Network Time Protocol (SNTP)” in chapter 4, *Ethernet Global Data*, for more information.

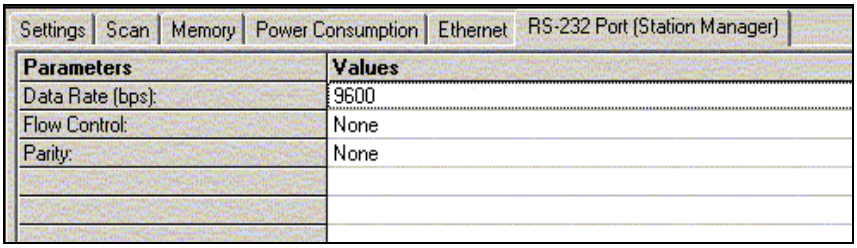
Max Number of Web Server Connections: The number of TCP connections allocated for use by the web server (not the number of web clients). Valid range is 0 through 16. The default is 2.

Max Number of FTP Server Connections: The number of TCP connections allocated for use by the FTP server. This is not the same as the number of FTP clients, because each FTP client uses two TCP connections when an FTP connection is established. Valid range is 0 through 16. Default is 2.

> **Note:** The sum of Max Web Server Connections and Max FTP Server Connections must not exceed 20 total connections.

RS-232 Port (Station Manager) Parameters for the CPU374 PLUS

The defaults should be used for most applications.



Data Rate: Data rate (bits per second) for the port. Choices are 1200, 2400, 4800, 9600, 19.2k, 38.4k, 57.6k, 115.2k. The default value is 9600.

Flow Control: Type of flow control to be used for the port. Choices are None or Hardware. (The Hardware flow control is RTS/CTS crossed). The default value is None.

Parity: Type of parity to be used for the port. Choices are None, Even, or Odd; the default value is None.

Configuring Ethernet Global Data

The most convenient way is to configure Ethernet Global Data is with the Ethernet Global Data server that is provided with the PLC programming software. This server holds the EGD configurations for all the devices in the EGD network. When the Configuration Server is used, the EGD configuration for the entire EGD network can be validated for accuracy before the configuration is stored into the devices of the network.

Note: By default, the Navigator window does not display the Ethernet Global Data component for new projects. If the Ethernet Global Data node does not appear in the Navigator Window immediately beneath the Data watch Lists, right-click the PLC target icon. Select 'Add Component' and then select 'Ethernet Global Data'. The Ethernet Global Data component should be displayed beneath Data Watch Lists.

Installing the EGD Configuration Server

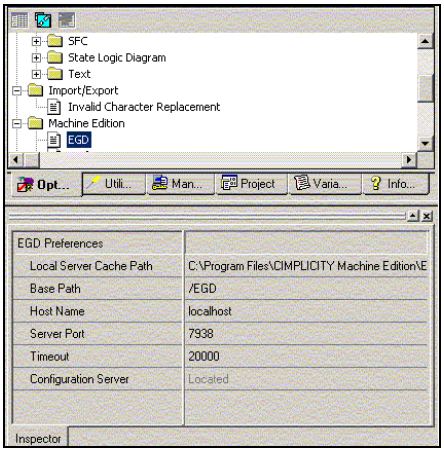
The EGD Configuration Server tool is supplied with the Machine Edition software, but it is not automatically installed with Machine Edition. If the EGD Configuration Server has not already been installed on the computer, follow these steps to install and configure the tool:

1. In Windows Explorer, navigate to the directory where the Machine Edition software is installed.
2. Open the folder named "EGD Installs".
3. Select the file "EgdCfgServerSetup.msi".
4. Double-click on the file to install the EGD Configuration Server.

Customizing the EGD Configuration Server

After installing the EGD Configuration Server, it can be customized as described below.

1. In Machine Edition, click on the Options tab in the Navigator window.



2. In the Machine Edition folder, select the EGD item to display the configuration options for the configuration server, which are shown above.

Local Server Cache Path : The path to be used for caching data from the configuration server. This cache is used if the server becomes inaccessible (for example, if the server is on another machine and network communications are lost). You can also choose to work offline from the server and use this cache. This mode of operation is explained below.

Base Path : Typically this field should not be changed from the default of /EGD. This is the path portion of the URL used to get to the server.

Host Name : The host name for the computer on which the configuration server runs. This can be specified as “localhost” if the server is on the local machine.

Server Port : This parameter typically is left at the default of 7938. If changed, it must be changed on both the programming software and on the server. This value is not stored in the project but is stored in the computer. It will be used as the default by other projects created on that computer and by other tools such as the EGD Management Tool, that require access to the server.

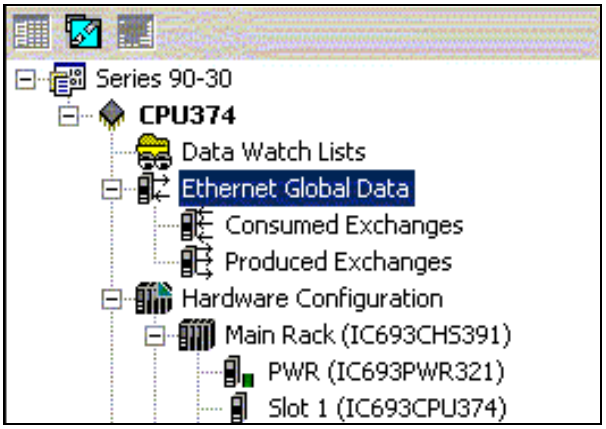
Timeout: The number of milliseconds the programming software will wait for a reply from the server before deciding that the server is not going to respond.

Configuration Server : This read-only parameter displays the value “Located” if the configuration server can be accessed and “Unable to Locate” if the server is not accessible.

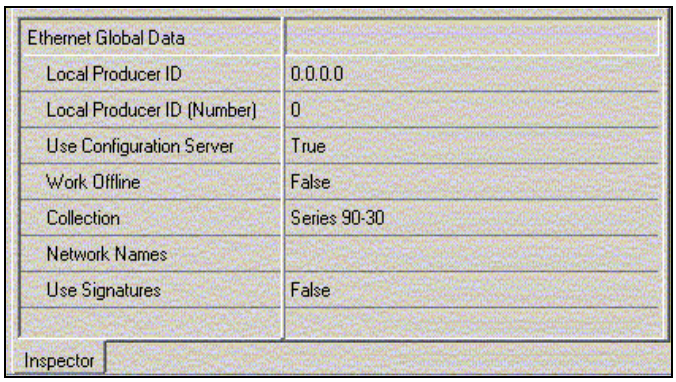
Enabling the Use of the EGD Configuration Server

In addition to installing the EGD Configuration Server on the computer, its use must be enabled for the CPU374 *PLUS*. This is done by default. However, if the EGD Configuration Server was previously disabled, it can be re-enabled as described below.

1. Right-click the Ethernet Global Data node:



2. Choose Properties to display the EGD Properties in the Inspector window.



Use Configuration Server: this should be set to True to enable using the configuration server for the CPU374 *PLUS*. Setting it to False disables the configuration server.

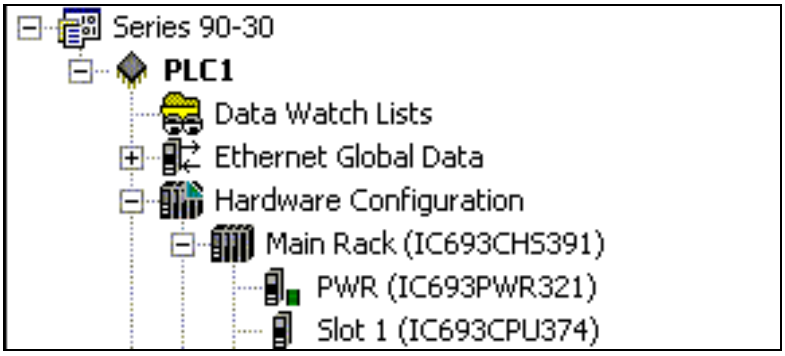
Work Offline: If this is set to True, work can be done offline from the configuration server, for example in order to work disconnected from the network or if the configuration server is located on another computer. When Work Offline is set to True, the programmer keeps a local copy of the EGD configuration information at a configurable path. Setting this path to a location on the local machine and setting Work Offline to True allows EGD configuration data to be updated using the saved information without accessing the server. Setting the Work Offline parameter to False and performing a Validate will synchronize the server with the data from the cache.

Network Names: n order to perform validation between producers and consumers, it is necessary to know whether the producer and the consumer are on the same network. The EGD Configuration Server and its validation libraries use the network name to perform this check. The validation assumes that two devices that have the same network name are connected to the same network. The Network Names parameter may be set to the name of the network to which the device is connected.

Collections: The EGD Management Tool is an optional utility that can be used to provide a system-level look at all the Ethernet Global Data devices in a system. The EGD Management Tool can look at subsets of EGD devices, called collections. A collection is a logical grouping of EGD devices (for example a manufacturing cell or a machine). To make an EGD device part of a collection, set the Collections parameter to the name of the collection for the device (by default the collection for a device is the Machine Edition project name).

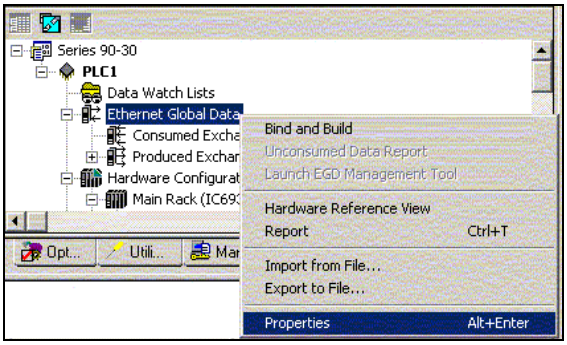
Basic EGD Configuration

If the Ethernet Global Data node does not appear (see the example below), right-click the PLC target icon (**PLC1** in this example). Select 'Add Component' and then select 'Ethernet Global Data'.

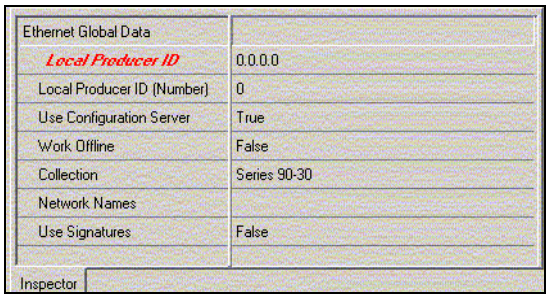


Configuring the EGD Properties

1. To configure the EGD Properties, right-click the Ethernet Global Data node and choose Properties.



2. The EGD Properties are shown in the Properties Inspector window:



The **Local Producer ID** is a 32-bit value that uniquely identifies this Ethernet Global Data device across the network. It can either be expressed as a dotted-decimal value in the same way an IP address value is specified or specified as an integer number. This value defaults to the IP address of the Ethernet Interface with the lowest rack/slot location in the

system. The same Producer ID applies to all exchanges produced by this CPU, regardless of which Ethernet interface is used to send the exchange to the network.

While the form of the Producer ID is sometimes the same as that of an IP address and an IP address is used as its default value, the Producer ID is ***not*** an IP address. See Chapter 4, Ethernet Global Data, for more information on how the Producer ID is used.

Use Signatures: Setting *Use Signatures* to True enables signature support in the device. False disables signature support. Ethernet Global Data signatures can be used to make sure that the format of the data from the producer matches that expected by the consumer.

The EGD signature is a numeric value that has two parts: the major number and the minor number. The major number reflects the “primary format” of the data. The minor number reflects backward-compatible changes made to the Ethernet Global Data exchange (such as adding data to the end of the exchange).

The primary format of the data is first established when the EGD exchange is defined. At that time the signature is assigned the value of 1.0. Any change that reorders, removes, renames or changes the type or offset of a variable in the exchange is a primary format change that causes the signature major number to be incremented. The signature major number must match between the producer and the consumer for the consumer to consume the data.

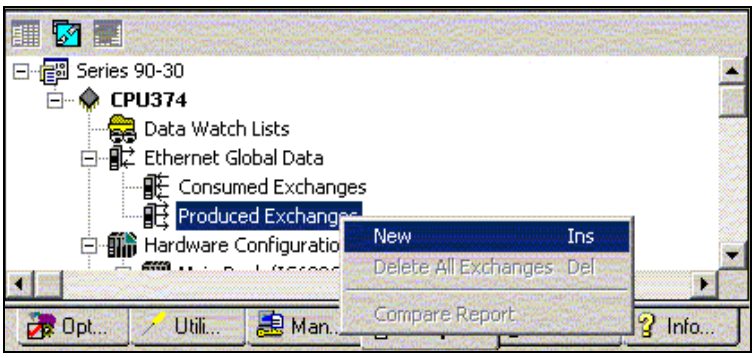
The signature minor number is incremented when backward-compatible changes are made in the format of the produced data. Backward-compatible changes are made by adding data to unused areas of the exchange including adding data to the end of the exchange. After checking the signature major number, the consumer checks the signature minor number. If the signature minor number in a sample is greater than the signature minor number configured for the exchange in the consumer then the consumer can consume the data truncating any unexpected data at the end of the sample. The consumer can do this because the minor number change guarantees that only backward-compatible changes have been made in the format of the data.

If the signature of a produced exchange is specified as zero, the consumers will not check it. If the signature of a consumed exchange is configured as zero, any signature from a producer is accepted, and if the data length exactly matches the expected length, the data is used.

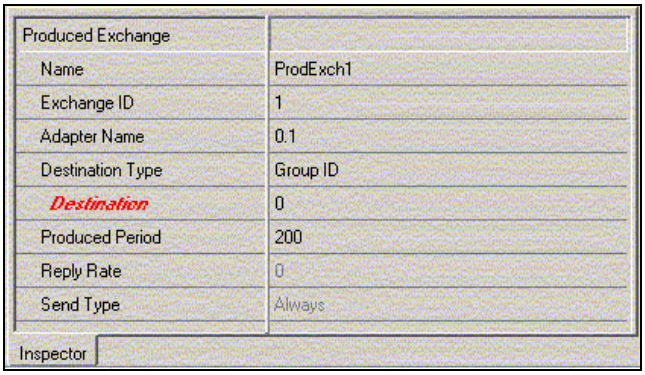
Use of signatures is enabled by default for CPU374 *PLUS*, as well as PACSystems RX7i and or RX3i targets. It is disabled for other targets and for existing projects. All other targets force the signature for both produced and consumed exchanges to be zero.

Configuring an Ethernet Global Data Exchange for a Producer

The information to be sent by the producer and the exchange details are defined in the Properties for each produced exchange (also called a “page”). To configure a produced exchange, right-click on Produced Exchanges in the Ethernet Global Data node, and select *New*:



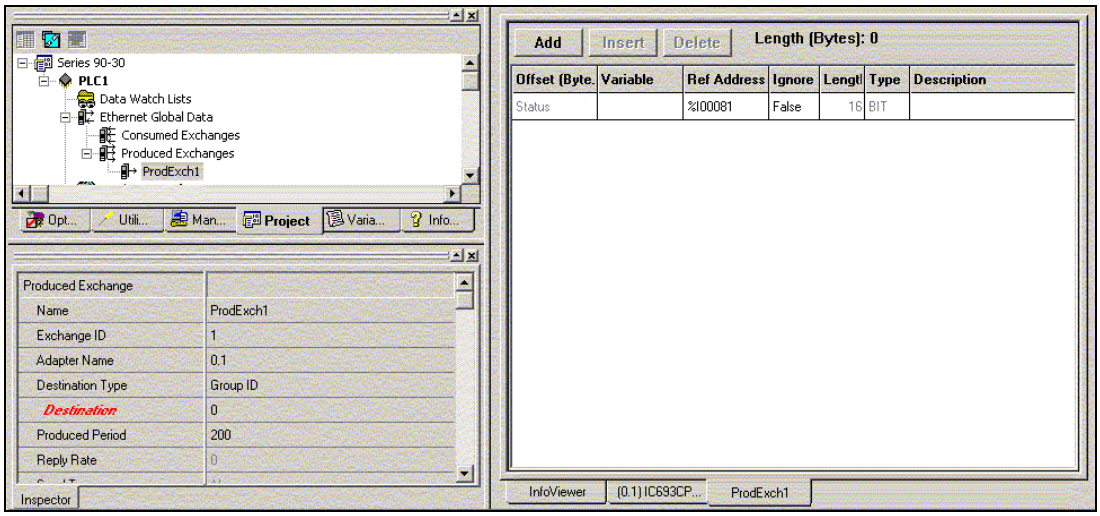
Use the Properties Inspector window to configure the properties of the exchange.



Name	A name assigned for this exchange. Defaults to “ProdExchX” where X is a sequential number.
Exchange ID	A number that identifies a specific exchange to be sent by the producing device.
Adapter Name	The specific Ethernet interface, identified by its rack and slot location within the producing PLC.
Destination Type	Specifies whether the data’s destination will be: ▪ An IP address (Unicast) ▪ A Group ID (Multicast) ▪ All EGD nodes on the subnet (Broadcast). Choosing broadcast will cause the EGD packets to be received by any node on the network. This can impact performance if there are non-EGD devices on the network. Check with the system’s network administrator if you are unsure about whether to use Broadcast.
Destination	Identifies the data’s consuming device, based on the Destination Type selected above: ▪ a dotted-decimal IP address if Destination Type is IP Address ▪ the group’s ID (1–32) if Destination Type is Group ID ▪ the value 255.255.255.255 If Broadcast IP is the Destination Type.
Produced Period	The scheduled repetition period at which the data is produced on the network. Configure a value in the range of 0 or 2–3,600,000 (2 milliseconds to 1 hour). The value zero means data will be produced at the end of each PLC scan, but not less than 2 milliseconds from the previous production. Set the production period to ½ the period at which the application needs the data in this exchange. Round this value up to the nearest 2 milliseconds.
Reply Rate	Not used.
Send Type	Fixed at “always.” In the PLC, production of EGD is controlled by the I/O state: when enabled, EGD production is enabled, and when disabled, EGD production is disabled.

Configuring the Produced Exchange Variables

Double-click on the produced exchange to open a window for configuring the variables within the exchange.



Each exchange has its own variable list. These variables contain the data that is produced to the network. Each variable contains the following information:

Offset (Byte.Bit)	The location within the data area for this exchange where the start of the data for this variable is located. The offset is expressed as **Byte.Bit**, where *Byte* is a zero-based byte offset and *Bit* is a zero-based bit position within that byte. (Valid bit values are 0-7. Bit 0 is the least-significant bit within the byte; bit 7 the most significant.)
Variable	The name defined for this variable. It may be an existing variable or it may be defined using the variable declaration facilities of the programmer such as the variable list in the Navigator.
Ref Address	The PLC memory reference address that contains the start of the data for this variable.
Ignore	Not used for Produced exchange.
Length	Size of the data for this variable, expressed in units of the data type.
Type	Data type of the variable.
Description	An optional text description of this variable.

To add a new variable to the end of the exchange, click the '**Add'** button. This does not change the data offsets of any existing variables within that exchange.

To insert a new variable among the existing variables, click on an existing variable. When you click the '**Insert'** button, a new variable will be created *ahead* of the selected existing variable. This changes the data offsets of all following variables in the exchange and will change the signature major number if you are using signatures.

Once a new variable has been entered, double-click a data field within the row to edit that value.

To delete an existing variable, click on the variable row and then click the '**Delete**' button. If you are using signatures, this will cause the signature major number to change.

Up to 100 variables may be configured for an exchange. The sum of the length for all variables in the exchange must not exceed 1400 bytes. The total length of the exchange is displayed as '**Length (Bytes):**' above the variable list.

A variable is automatically created for the local exchange status that is returned to the PLC logic application. The exchange status is not part of the produced exchange data and is not available to the network.

Configuring an Ethernet Global Data Exchange for a Consumer

To create a new consumed exchange, right-click the “Consumed Exchanges” node and select “New”. A dialog box lists all produced exchanges in the EGD network that have been published to the EGD Configuration Server. Select the exchange to be consumed. Once selected, the exchange is populated with the variable, length, type and description information defined in the producer. The variable name consists of the target name, an underscore, and the variable name in the producer. (See below for information about name generation.) Enter a reference address or select “ignore” for each variable in the exchange. Assign an adapter name and a timeout for the exchange. With these steps, the configuration of the consumer is complete.

When an individual consumed exchange is selected, the following parameters can be configured in the Properties Inspector window. Typically, only the adapter name and the update timeout need to be specified for the exchange and the reference address specified for the variables in the exchange. Changing any other values in a consumed exchange should only be done with expert help.

Name	A name assigned for this exchange. Defaults to the target name of the producer, an underscore, and the exchange ID in the producer. Changing this name may make resynchronization of the variable with the server impossible.
Producer ID	The ID of the PLC producing the exchange. Producer ID is defined by the producer; changing here it may make resynchronization with the server impossible.
Group ID	Used only if the produced exchange has been configured with a Destination Type of Group ID. Group ID is defined by the producer; changing it here may make it impossible to consume the data from the producer.
Exchange ID	Identifies a specific data exchange to be received by the consuming device. Exchange ID is defined by the producer; changing it here may make resynchronization with the server impossible.
Adapter Name	The specific Ethernet interface, identified by its rack and slot location within the consuming PLC.
Consumed Period	Not used. (Always displayed as 200 milliseconds; not editable.)
Update Timeout	A value in the range 0 to 3,600,000 milliseconds (1 hour). The Ethernet interface will declare a refresh error if the first or subsequent packet of data does not arrive within this time. The Update Timeout should be at least double the producer period, and should allow for transient network delays. The default is 0 indicates no timeout. Resolution is in 2ms increments.

Name Generation for Consumed Variable

The EGD configuration server automatically creates consumed variables, based on the variable name in the producer. The name consists of up to seven characters of the beginning of the target name of the producer followed by an underscore character "_" followed by up to 21 characters of the beginning of the variable name of the variable in the producer. Because the PLC programming software allows names of up to 32 characters, it is possible that the generated name for a consumed variable will not be unique. This can occur when the target names of producers have the same first seven characters and variable names have the same first 21 characters. When the generated variable is not unique, the variable in the consumer has an underscore character and a two-digit number appended to it to make it unique.

When not using the EGD configuration server, consumed variable names default to "ConsExchX" where X is a sequential number.

Synchronizing a Consumed Exchange with Changes in the Producer

If a produced exchange is changed, it is necessary to reflect these changes in the consumers. This can be done very quickly with the EGD configuration server. Once the new definition of the produced exchange has been published to the server, select the consumed exchange in each consumer, right-click and select synchronize to server. The new definition of the produced exchange is brought in from the server. Any variables that have been added to the producer must have reference addresses assigned if they are to be used or they must be selected as "ignore". No other action is necessary in the consumer.

Selective Consumption

Not all data ranges within a produced exchange need to be consumed by each PLC. For example, a producer is producing an exchange consisting of a 4-byte floating point value, followed by a 2-byte integer, followed by a 2-byte analog value. If the consuming PLC wants to consume only the analog value and place it into %AI003, the consumer might be configured as shown below.

Offset	Variable	Ref Address	Ignore	Length	Type	Description
0.0		Ignore	True	6	Byte	Ignore float and integer
6.0	Var01	%AI0003		1	WORD	

Note that where EGD signatures are not used the total length of the exchange must be the same in producer and consumer, even if the consumer is ignoring a portion of the exchange. Failure to configure any ignored bytes in the consumed exchange results in exchange exception log and fault table entries, error status in the exchange status data, and no data being transferred for the exchange.

Validating the EGD for a Device

One advantage of using the EGD configuration server is the ability to validate the EGD configuration before downloading the configuration to the device. If you right-click on the Ethernet Global Data node in the Navigator, you will see a selection for “Bind and Build”. Selecting this menu item causes the EGD definitions for the target to be cross-checked against the definitions in the server. Each consumed exchange is compared to the produced exchange published by the producer and any discrepancies are noted (see above for how to correct any errors detected in the consumer).

It is also possible, by selecting the menu item “Unconsumed Data Report”, to generate a report listing any variables in produced exchanges that are not being used by a consumer. Producing data that is not being consumed is not necessarily an error; the consumer may not be able to publish its information to the EGD configuration server or the application design may have chosen to publish data that is not needed immediately. However, each unconsumed variable may be an indication of an error or oversight in one or more consumers in the application.

Looking at the Entire EGD Network

The EGD Management Tool can be used to display information about the entire EGD network both offline and online to that network. You can launch the EGD Management Tool by right clicking on the Ethernet Global Data node in the Navigator and selecting “Launch EGD Management Tool”. The EGD Management Tool opens in separate frame. It allows you to visualize, analyze and debug an EGD network. See Chapter 9, Diagnostics, for more information on the online capabilities of the EMT. Also see the EMT online help for information about running the EMT.

Installing the EGD Generic Device Editor

Some devices, for example, certain Ethernet NIUs cannot be configured using the EGD configuration server. Configuration tools for third-party devices that support Ethernet Global Data may not support the EGD configuration server. Rather than not using the EGD configuration server in applications that contain these devices, there is an alternative that allows the EGD configuration for such devices to be put into the server so that it can be used for consumption and validation in other devices.

The programmer distribution includes a tool called the EGD Generic Device Editor. This tool allows you to describe the EGD configuration of a device and publish it to the EGD configuration server. Configuration tools for other devices can use the EGD configuration published by the EGD Generic Device Editor for consumption or validation purposes.

Installing the EGD Generic Device Editor

The EGD Generic Device Editor is not automatically installed when you install the Programmer. To install the EGD Generic Device Editor, look in the directory where you installed the programmer and you will find a subdirectory named “EGD Installs”. In that directory, you will find a file named “EgdGenericEditorSetup.msi”. Double-click on this file to install the EGD Generic Device Editor.

Running the EGD Generic Device Editor

Installing the EGD Generic Device Editor adds it to the Start – Programs menu of the computer’s Windows system. You will find it under Programs - GE Industrial Systems-EGD Generic Editor. The online help for this tool describes its operation.

Configuring Ethernet Global Data Without Using the EGD Configuration Server

If the EGD Configuration Server is not used, each Ethernet Global Data exchange must be configured in both the producer and the consumer. To add exchanges, expand the Ethernet Global Data node in the Project tab. Right click the Consumed Exchanges or the Produced Exchanges node and choose New. The new exchange appears under the selected list node.

For each Consumed and Produced Exchange, configure the parameters described earlier.

Chapter 4 Ethernet Global Data

This chapter describes basic Ethernet Global Data features a Series 90-30 CPU374 *PLUS* enhanced Ethernet interface.

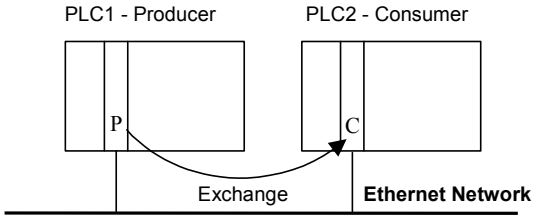
- Ethernet Global Data Operation
- EGD Exchanges
- The Content of an EGD Exchange
  - The Data Ranges (Variables) in an EGD Exchange
  - Valid Memory Types for Ethernet Global Data
  - Planning Exchanges
  - Using Ethernet Global Data in a Redundancy System
- Sending an Ethernet Global Data Exchange to Multiple Consumers
  - Multicasting Ethernet Global Data
  - Broadcasting Ethernet Global Data
- Ethernet Global Data Timing
  - Configurable Producer Period for an EGD Exchange
  - Consumer Update Timeout Period
  - EGD Synchronization
  - Timestamping for Ethernet Global Data Exchanges
  - Effect of PLC Modes and Actions on EGD Operations
- Valid PLC Memory Types for Ethernet Global Data
- Monitoring Ethernet Global Data Exchange Status

Ethernet Global Data Operation

Ethernet Global Data is data that is automatically sent from one Ethernet device to one or more others. Once Ethernet Global Data has been configured, the data is sent automatically during system operation. No program interaction is necessary to produce or consume the global data.

The device that sends the Ethernet Global Data is called the *producer*. Each device that receives Ethernet Global Data is called a *consumer*. Each unique Ethernet Global Data message is called an *exchange* (also sometimes referred to as a *page*).

An Ethernet interface can be configured to both produce and consume Ethernet Global Data at the same time, using separate exchanges.



The EGD Producer

The producer of an exchange periodically sends new samples of data from its local internal memory. The producer of an exchange is uniquely identified by its Producer ID. The Producer ID can be expressed as a dotted-decimal number (for example, 0.0.0.1). Even when expressed in IP address form, it is not used as an IP address. It is used to identify a particular PLC on the network. Since the Producer ID identifies only the PLC producing the exchange, it doesn't matter how many Ethernet Interfaces are installed in that PLC.

When using the Ethernet Global Data configuration server, each PLC that transfers EGD must be assigned a Producer ID even if that PLC produces no exchanges. The Producer ID uniquely identifies each EGD device in the configuration server and must be present if the server is used.

EGD Consumers

A consumer is a device that will update its local internal memory based on the data in an exchange. The consumer is identified at the producer by an IP Address, a Group ID, or a local subnet broadcast IP address based upon the Subnet Mask, depending on the Destination Type selected.

The Consumed Exchange configuration allows "selective consumption" of a produced EGD exchange. The consumer takes in the whole exchange from the network but does not need to send all of the exchange to the PLC memory. This feature is called Selective Consumption. A Consumed Exchange can be set to ignore the data ranges (variables) that are not needed.

EGD Exchanges

Each exchange in EGD is identified by its Producer ID and Exchange ID. Up to 128 exchanges can be configured for a CPU374 *PLUS* enhanced Ethernet interface. They can be divided into any combination of produced and consumed exchanges. Each exchange can be up to 1400 bytes in length.

Different produced exchanges can include some or all of the same data even though the exchanges are produced at different rates and sent to different consumers. Consumed Exchanges should not duplicate where the data is put as variable conflicts will occur and data will be overwritten by the multiple exchanges

Caution

Ethernet Global Data is designed for simple, efficient communication of sampled data between devices. It is not intended for event notification where the possible loss of a sample of data would be significant.

Some EGD devices support the concept of an EGD “page”. An EGD page consists of one or more exchanges that are produced on the same schedule to the same destination. Pages remove the 1400 byte size limitation of EGD exchanges. Machine Edition does not currently show information about EGD pages, you will instead see the constituent exchanges for each page.

The Content of an Ethernet Global Data Exchange

Each Ethernet Global Data exchange is composed of one or more data ranges transmitted as a sequence of 1 to 1400 bytes of data. The data ranges are commonly called variables; they may be configured to correspond to PLC variables. The content of the data is defined for both the producer and consumers of the data. In this example, a producer sends an 11-byte exchange consisting of the current contents of %R00100 through %R00104 followed by the current contents of %I00257 through %I00264:

Address	*Length*	*Type*	*Description*
%R00100	5	WORD	Conveyor1 in PLC1
%I00257	1	BYTE	Conveyor1 limit switch in PLC1

The same exchange can be configured at each consumer to suit the needs of the application.

The Data Ranges (Variables) in an Ethernet Global Data Exchange

The variables within an exchange are defined in the Ethernet Global Data configuration in hardware configuration. There can be:

- Up to 100 data ranges per exchange.
- A length of 1 byte to 1400 bytes per exchange. The total size of an exchange is the sum of the data lengths of all of the data ranges configured for that exchange.

Different produced exchanges may share some or all of the same data ranges even if the exchanges are produced at different rates. A consumer does not have to consume all of the data from a produced exchange. A consumed exchange may be configured to ignore specified data ranges. (See “Selective Consumption” in chapter 3, Configuration.)

Valid PLC Memory Types for Ethernet Global Data

The PLC memory types listed below can be included in EGD exchanges at the CPU374 *PLUS*.

	Description	***P-Producer C-Consumer***
%R	Register memory in word mode	P/C
%AI	Analog input memory in word mode	P/C
%AQ	Analog output memory in word mode	P/C
%I	Discrete input memory in byte mode	P/C
%Q	Discrete output memory in byte mode	P/C
%T	Discrete temporary memory in byte mode	P/C
%M	Discrete momentary memory in byte mode	P/C
%SA	Discrete system memory group A in byte mode	P/C
%SB	Discrete system memory group B in byte mode	P/C
%SC	Discrete system memory group C in byte mode	P/C
%S	Discrete system memory in byte mode	P
%G	Discrete global data table in byte mode	P/C

Discrete point references such as %I or %Q are configured as Byte-Array, Word-Array, or Dword-Array variables. That means a variable with discrete point references must be defined in blocks of 8 points if it is defined as a Byte-Array, 16 points if Word-Array, and 32 points if Dword-Array. Discrete memory must be byte-aligned.

Boolean type and Boolean-Array variables are not allowed.

Planning Exchanges

It is possible to configure more Ethernet Global Data than a PLC can transfer (especially on 10Mbit networks). If high levels of consumer timeouts occur in some or all of the consumed exchanges, the EGD load can be reduced by:

- Increasing the production period (especially if the period is more frequent than double the minimum time in which the data is needed).
- Defining fewer exchanges, each with more data.
- Using EGD groups or broadcasting to subnets. Rather than producing a directed exchange to several destinations, a single exchange can contain all the data and each consumer can transfer only the data it needs from the exchange.

Sending an Ethernet Global Data Exchange to Multiple Consumers

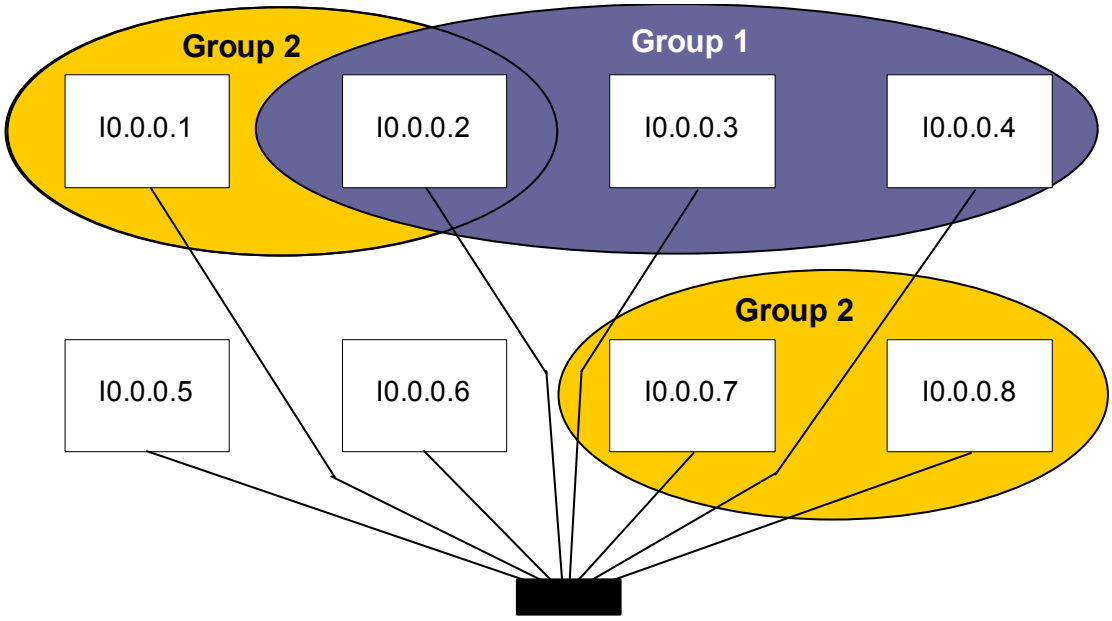
There are two ways to send an EGD Exchange to multiple consumers at the same time: by Multicasting it to a predefined group of consumers or by Broadcasting it to all of the consumers on a subnet. Both methods allow many consumer devices to simultaneously receive the same data from one producing EGD device. If an exchange is Broadcast or Multicast, the same exchange must be configured at the producer and at each consumer. Each consumer can use all of the data or just a selected portion, as configured for the consumed exchanges.

For more information about Multicasting and Broadcasting, refer to chapter 6, Network Administration.

Multicasting Ethernet Global Data

If more than one device on the network should consume a Global Data exchange, those devices can be set up as a group. The network can include up to 32 numbered groups. Groups allow each sample from the producer to be seen simultaneously by all consumers in the group.

A device can belong to more than one group, as illustrated below.



Each device in a group responds to the group's assigned ID number from 1 to 32.

Each Group ID corresponds to a Multicast (Class D) IP address reserved by the Internet authorities. The default Multicast IP addresses used by Ethernet Global Data are:

Group ID	*IP Address*
1	224.0.7.1
2	224.0.7.2
.	.
.	.
.	.
32	224.0.7.32

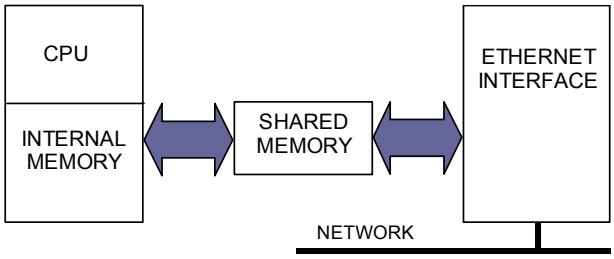
Group Multicast IP Addresses used by Ethernet Global Data should not be changed unless the defaults would cause a network conflict. If necessary, they can be changed within the reserved range of multicast IP addresses (224.0.0.0 through 239.255.255.255). The change must be made using an Advanced User Parameter File.

Broadcasting Ethernet Global Data

The same Ethernet Global Data exchange can be sent to all of the consumers on a subnet by configuring the Produced Exchange to use a Destination Type of ”Broadcast”. The “Destination” of that exchange then changes to the value 255.255.255.255. (The Ethernet interface converts this value to the appropriate subnet broadcast mask for this network.) As with a Group ID, each consumer on the subnet can be configured to use some or all of the exchange.

Ethernet Global Data Timing

The CPU374 *PLUS* enhanced Ethernet interface utilizes a shared internal memory for Ethernet Global Data operations.



When the CPU374 *PLUS* is the producing PLC, the CPU updates its EGD internal memory with a data sample when requested by its Ethernet interface. The update affects the length of the PLC sweep only for that particular exchange; it has little effect on the PLC average sweep time. When the Ethernet interface's producer period expires, it produces the data sample from shared internal memory onto the network.

When the CPU374 *PLUS* is the consuming PLC, shared internal memory is updated as soon as the Ethernet interface gets a data sample from the network. There is no configurable consumer period. The CPU updates its reference tables from shared internal memory at the end of the sweep after it is notified by the Ethernet interface that fresh data has arrived for a specific exchange. The data is made available to the application on the next PLC sweep after it is received. Some other types of Ethernet interfaces implement a consumption period timer.

EGD Synchronization

Ethernet Global Data attempts to provide the most up-to-date process data, consistent with the configured schedule.

The Ethernet interface maintains a timer for each produced exchange. When the timer for the exchange expires, the Ethernet interface requests that the data for the exchange be transferred from reference memory during the output scan portion of the CPU sweep. At the output portion of the sweep, the CPU puts the data into the shared memory. Once the data has been transferred by the CPU sweep, the Ethernet interface immediately formulates a sample and transfers the sample on the network. (If updated data is not available at the next production timer expiration, the Ethernet interface produces a sample containing the previous data to the network.)

As soon as a sample for a consumed exchange is received, it is transferred to the CPU during the next input scan portion of the CPU sweep.

The result of this scheduling method for Ethernet Global Data is a variability of up to one producer CPU sweep time in the interval between samples produced on the network. This

variability in the time between samples is present to assure that the most up-to-date data is being transferred.

In general, it is not useful or necessary to configure the production period to be less than the CPU sweep time. If the producer period for an exchange is set lower than the CPU sweep time, the Ethernet interface will send a “stale” sample (a sample containing the same data as previously sent) at the configured interval. When the fresh CPU data becomes available at the end of the sweep, the Ethernet interface will immediately send another sample with the fresh data. The timer of the produced exchange is not reset when this sample is sent. This can result in more samples in the network than would be expected from the configured period.

Configurable Producer Period for an EGD Exchange

The Producer period for an EGD exchange can be 2 milliseconds to one hour. In the PLC, the Ethernet interface attempts to produce the data at this interval. As explained above, the exchange production may vary from the configured interval by up to one production period or one producer CPU sweep period, which ever is smaller.

Producer period is configurable in increments of 2 milliseconds. If the Producer Period is set to zero, production is scheduled every scan or every 2ms, whichever is slower. In a PLC with rapid scan times, scheduling a produced exchange at zero results in a very high load on the network and on the Ethernet interface, which can degrade overall Ethernet performance. Scheduling multiple exchanges for a zero period in a PLC with a low scan time can result in the Ethernet interface being unable to produce all the required data, and will also degrade SRTP communication.

Consumer Update Timeout Period

For each consumed exchange, an Update Timeout period can be configured. It determines how long the Ethernet interface will wait for the starting or subsequent packet of data in the exchange before declaring a refresh error. The update timeout period for the consumer should be set to at least twice the producer period. At very small producer periods, the update timeout should also allow for network transfer variation. Otherwise, the PLC may occasionally falsely report refresh faults. Use zero for the update timeout period of a consumed exchange to disable timeout detection.

Producer Period Guidelines for PLCs

Do not produce and consume data faster than is required by your application. This reduces the load on the network and on the devices, providing capacity for other transfers.

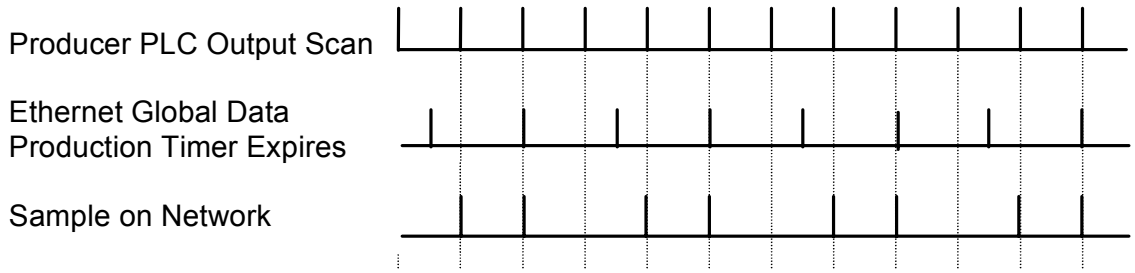
Timing Examples

The following illustrations show the relationship between the PLC output scan time, the produced exchange timer, and data samples on the network.

Example 1

Only one sample is produced on the network per producer period expiration. The variability between samples can be up to producer CPU sweep time.

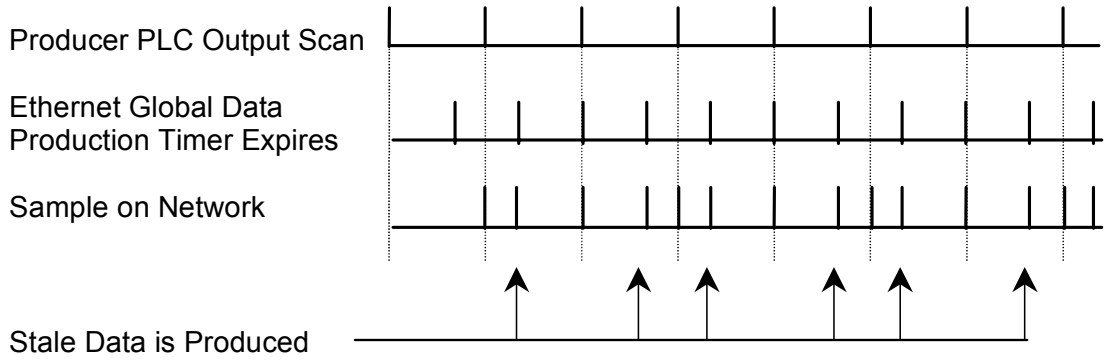
Producer Period = 1.5 Times CPU Sweep



Example 2

More than one sample can be produced per producer period expiration and stale samples are produced to the network.

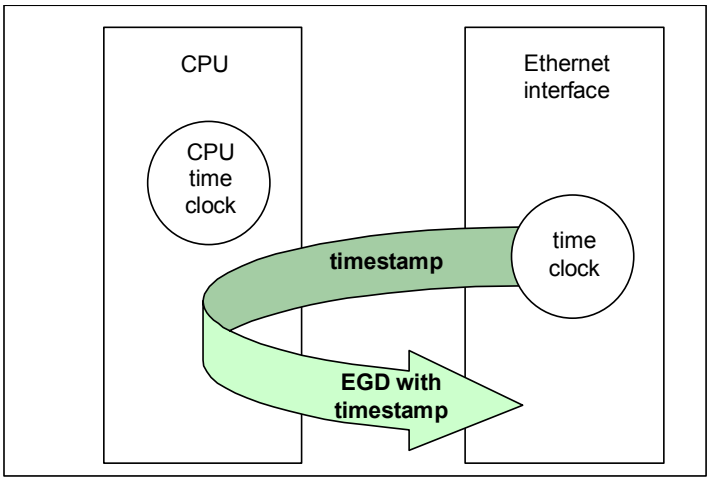
Producer Period = 2/3 Time of CPU Sweep



Timestamping of Ethernet Global Data Exchanges

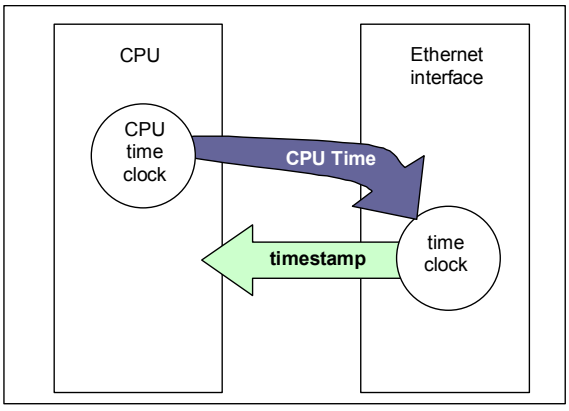
The CPU adds a timestamp to each Ethernet Global Data Message it produces. The timestamp indicates when the data was provided to the Ethernet interface for transmission over the network.

The timestamp is an 8-byte value representing the time elapsed since midnight, January 1, 1970. The first four bytes contain a signed integer representing seconds and the next four bytes contain a signed integer representing nanoseconds. This value can be examined to determine whether a packet received from the network has a new data sample or if it is the same data received previously.

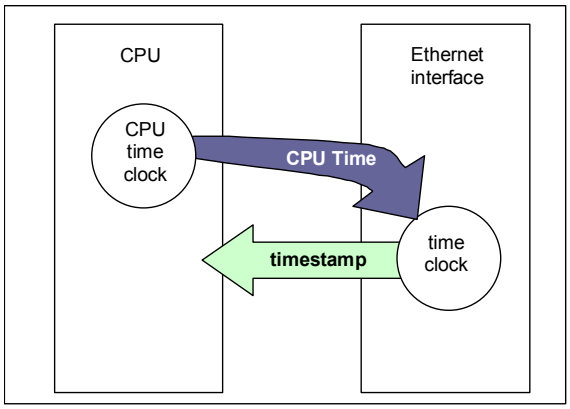


The PLC CPU obtains the timestamp data from the time clock in the Ethernet interface. The CPU only uses this timestamp for Ethernet Global Data exchanges. The timestamp from the Ethernet interface does not affect the time of the CPU's internal time clock.

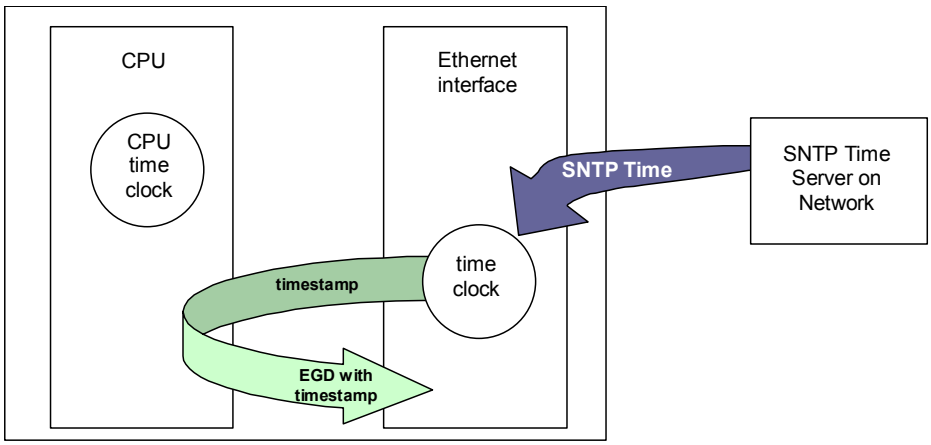
The time clock in the Ethernet Interface is synchronized to either the clock in the CPU or an external SNTP server on the network. Selection of the timestamp source for Ethernet Global Data is part of the basic configuration of the Ethernet Interface, as explained in chapter 3, Configuration.



PLC's Time Clock: If this source is configured, the Ethernet Interface's built-in time clock is synchronized at power-up or at restart to the clock in the PLC CPU. The timestamp information produced by the PLC has a resolution of 100 microseconds. Because the time clocks in the PLCs on the network are not synchronized, EGD timestamps produced by different PLCs cannot be compared accurately.



SNTP Server's Time Clock: if this source is configured, the Ethernet interface's built-in clock is periodically synchronized to the clock on an SNTP server on the network. All Ethernet Interfaces configured to use SNTP will have updated, synchronized timestamps. Therefore, accurate timing comparisons between exchanged data can be made. If SNTP is used to perform network time synchronization, the timestamp information typically has ±10 millisecond accuracy between PLCs on the same network.



SNTP Operation

In an SNTP system, a computer on the network (called an SNTP server) sends out a periodic timing message to all of the SNTP-capable Ethernet interfaces on the network, which keep their internal clocks synchronized with this SNTP timing message.

SNTP server dates before January 1, 1989 are not supported.

Normal SNTP Operation

The Ethernet interface will synchronize to a remote SNTP time server after receiving two broadcast clock values within a 150-second period. The Station Manager can be used to view server status information.

Multiple SNTP Servers

To guard against loss of SNTP timing messages, multiple SNTP time servers can be tracked on a network. An Ethernet Interface can maintain timing information from up to four total SNTP time servers at a time. Each server assigns a stratum number that determines its priority. The message from the server with the lowest stratum number is used by the Ethernet interface until communication with that server is lost. Then the server with the next lowest stratum number becomes the server of choice and the Ethernet interface synchronizes to it if it receives two of its timing messages within a 150-second period. A server is considered "lost" if more than 150 seconds elapse between timing messages.

Loss or Absence of SNTP Timing Signals

If an Ethernet interface is configured for SNTP, but does not receive two timing messages from an SNTP network time server within a 150-second period, the following will happen:

- A fault entry will be placed in the PLC Fault Table.
- A fault entry will be placed in the Ethernet interface's exception log. This log can be read using the Station Manager.
- The Status word within a consumed exchange will indicate new data with a value of 3, instead of the normal 1 value. That means SNTP is selected, but the Ethernet interface is not synchronized to an SNTP server. This Status word value can be obtained from the PLC register configured for the particular exchange.

Note: The SNTP error condition is considered the least important of all possible error codes. Therefore, if another error condition exists, its status code will appear in the Status word instead of the SNTP error code.

Upon loss or absence of synchronization, the Ethernet interface’s built-in clock will operate as follows:

- If the Ethernet interface, after its last power-up/restart cycle, has never received an SNTP server's timing message, it will continue to use the PLC CPU's local clock value that it received at power-up/restart for its time base.
- If the Ethernet interface has been synchronized to an SNTP server but lost its signal, it will use the most recently received SNTP time message as its time base.

The Ethernet interface continues supplying time values to the PLC CPU for timestamping, while it "listens" for SNTP timing messages from the network. If SNTP messages are received later, the Ethernet interface synchronizes to them

Effect of PLC Modes and Actions on EGD Operations

The configuration and operation of Ethernet Global Data may be affected by the PLC's current mode and by certain PLC actions:

- The normal PLC mode for EGD operation is RUN with Outputs enabled. In this PLC mode, Ethernet Global Data remains configured and exchanges are both produced and consumed.
- If the PLC mode is set to STOP with I/O disabled, the Producer ID remains configured, but production and consumption stop. Note that while consumed data is not transferred to the PLC memory in this mode, data from the network is still transferred to the shared memory so that the latest data is available immediately when the PLC transitions out of STOP with I/O disabled mode.
- If configuration is lost, the Ethernet Global Data configuration must be stored again.

PLC Mode or Action	***Producer ID remains configured***	***Configuration-Based Exchanges continue to be***		
		Configured	***Produced***	***Consumed***
PLC Mode				
RUN-Outputs Enabled	YES	YES	YES	YES
RUN-SUSPEND I/O [1]	YES	YES	NO	NO
STOP-I/O Enabled	YES	YES	YES	YES
STOP-I/O Disabled	YES	YES	NO	NO
PLC Action				
RUN-Store Logic	YES	YES	YES	YES
STOP-Store Logic	YES	YES	*	*
STOP-Clear Logic	YES	YES	*	*
STOP-Config Store	Replaced[2]	Replaced[2]	NO[3]	NO[3]
STOP-Clear Config	NO	NO	NO	NO
PLC Power Cycle	YES	YES	*[3]	*[3]
Ethernet Interface Restart	YES	YES	*[3]	*[3]

[*] Production and consumption is controlled by the PLC Mode as described above.

[1] RUN-SUSPEND I/O refers to the SUSIO logic function. (The DOIO logic function does not affect EGD production or consumption.)

[2] Producer ID and exchange definitions are replaced.

[3] Producer ID and exchange states depend on the PLC mode and configuration prior to the action.

Monitoring Ethernet Global Data Exchange Status

The Exchange Status word is used to store status information about an EGD exchange. A unique Exchange Status word location must be is configured for each exchange.

The PLC writes status codes into the Exchange Status word whenever an exchange is transferred or a consumer timeout occurs

The Exchange Status word is typically set to 1, indicating that when the period expired, there was no error condition. The application program can monitor for error conditions reported in the Exchange Status word by setting it to 0 once a non-zero value is written to it. The program should also monitor the “LAN Interface OK” Status bit (see chapter 8, Diagnostics) for each of the Ethernet interfaces performing EGD. The Exchange Status word is invalid if the bit is 0.

Note that when an EGD exchange message received from the network contains an invalid Protocol Version Number, the Ethernet interface cannot decode the message in order to identify the exchange. In this case, the Exchange Status Word cannot be updated.

Exchange Status Word Error Codes

The following table shows the error codes that can be written to the Exchange Status word in the Producer (P) and Consumer. The Exchange Status Word value for each exchange may be displayed via the STAT G Station Manager command. The Exchange Status Word values are displayed within parentheses.

Value (Dec.)	P / C	Error	Description
0	P/C	No new status event has occurred.	Produced: Initial value until the first producer period refresh occurs. Consumed: The data has not been refreshed since the previous consumption scan and the consumer timeout has not expired.
1	P	No error currently exists.	The exchange is producing data. This value should be ignored in the Output Disabled PLC modes.
1	C	No error, data consumed.	The data has been refreshed on schedule since the previous consumption.
3	C	SNTP error.	The Ethernet interface in the producer is configured for network time synchronization, but is not synchronized to an SNTP server. The data was refreshed on schedule.
4	P/C	Specification error.	During exchange configuration, an invalid configuration parameter was received by the Ethernet interface or an error occurred in communication with the PLC CPU.
6	C	Refresh timeout without data.	The exchange's timeout period is configured to a non-zero value and the data has not been refreshed within the timeout period.
7	C	Data after refresh timeout.	The data has been refreshed since the previous consumption, but not within the timeout period.
10	P/C	IP Layer not currently initialized.	This status can be set during exchange configuration* if the Ethernet interface detects that it cannot currently access a network. This temporary status can change if successful network access becomes possible.
12	P/C	Lack of resource error.	Local resources are not available to establish the exchange during exchange configuration*. The PLC Fault Table may provide more detail on the specific error.
14	C	Data size mismatch error	The data size of a consumed exchange does not match the exchange definition. The exchange is ignored.

Note: The CPU374 *PLUS* Ethernet interface does not support EGD exchange status values 16, 18, 22, 26, 28, and 30.

* Exchange configuration occurs when either 1) Hardware Configuration containing EGD is stored to the PLC, 2) a PLC containing EGD configuration powers up, or 3) an Ethernet Interface configured for EGD is restarted.

Chapter 5 Programming EGD Commands

This chapter describes a set of commands that can be used in the application program to read and write data over the Ethernet network:

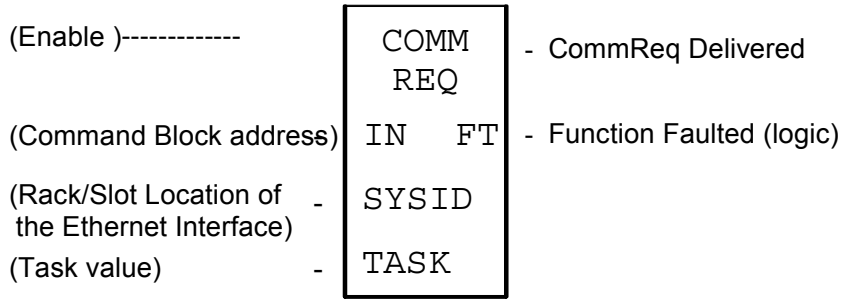
- Read PLC Memory
- Write PLC Memory
- Read EGD Exchange
- Write EGD Exchange
- Masked Write to EGD Exchange

EGD Commands are supported by the enhanced CPU374 *PLUS* Ethernet interface. This feature is not available in CPU374 versions prior to Release 12.00.

COMMREQ Format for Programming EGD Commands

The EGD commands described in this chapter are sent using the Communications Request (COMMREQ) function.

The Communications Request is triggered when the logic program passes power to the COMMREQ Function Block.



For the EGD commands, the parameters of the COMMREQ are:

Enable: Control logic for activating the COMMREQ Function Block.

IN: The location of the Command Block. The Command Block contains the parameters of the COMMREQ request. It can be located at any valid address within a word-oriented memory area (%R, %AI, or %AQ in the PLC.

SYSID: A hexadecimal word value that gives the rack (high byte) and slot (low byte) location of the CPU module. For the CPU374 *PLUS,* this must be Rack 0, Slot 1 (= 0001H).

TASK: For the CPU374 *PLUS* Ethernet interface, Task must be set to 21decimal (=0015H).

FT Output: The FT output is set if the PLC CPU is unable to deliver the COMMREQ to the Ethernet interface. When the FT output is set, the Ethernet interface is unable to return a COMMREQ status word to the PLC logic application.

COMMREQ Status for the EGD Commands

Words 3 and 4 of every COMMREQ Command Block specify a memory type and location to receive status information about the execution of the command.

Word 3 specifies the memory type for the COMMREQ status word. The memory types are listed in the table below:

Type	Value (Decimal)	Value (Hex.)	Description
%R	8	08H	Register memory (word mode)
%AI	10	0AH	Analog input memory (word mode)
%AQ	12	0CH	Analog output memory (word mode)
%I	16	10H	Discrete input memory (byte mode)
	70	46H	Discrete input memory (bit mode)
%Q	18	12H	Discrete output memory (byte mode)
	72	48H	Discrete output memory (bit mode)
%T	20	14H	Discrete temporary memory (byte mode)
	74	4AH	Discrete temporary memory (bit mode)
%M	22	16H	Discrete momentary internal memory (byte mode)
	76	4CH	Discrete momentary internal memory (bit mode)
%G	56	38H	Discrete global data table (byte mode)
	86	56H	Discrete global data table (bit mode)

Word 4 of the COMMREQ Command Block specifies the offset within the memory type selected. ***The status word address offset is a zero-based number.*** For example, if %R1 should be the location of the status word, you must specify a zero for the offset. The offset for %R100 would be 99 decimal.

COMMREQ Status Values

The Ethernet Interface reports the status of the COMMREQ back to the status location. See chapter 9, Diagnostics, for COMMREQ status values that may be reported for the EGD commands.

Read PLC Memory (4000)

The Read PLC Memory command can be used to read memory locations from a remote PACSystems PLC. This command does not require configuration of a produced / consumed exchange in the PLCs. The Read PLC Memory command can only be sent to an individual IP Address; it cannot be sent to a Group ID (multicast).

Read PLC Memory Command Block

Word Offset	Value	Description
Word 1	Length of command data block, including optional password data	16 plus number of words of optional password data. (See Word 22 description.)
Word 2	0	Always 0 (no-wait mode request)
Word 3	(See previous page)	Memory type of COMMREQ Status Word
Word 4	0-based.	Offset of COMMREQ Status Word
Word 5	0	Reserved
Word 6	0	Reserved
Word 7	4000 (fa0H))	Read PLC Memory command number.
Word 8	Timeout, in milliseconds	The maximum time to wait for a response, in 10-millisecond increments. Default is 1000ms. A timeout must be specified. If 0 is entered, the default of 1000ms is used.
Word 9	Local read buffer memory type	Memory type for the data to be placed in the local PLC.
Word 10, Word 11	Local read buffer reference table starting address	1-based offset in the local PLC
Word 12	Remote read location memory type	Memory type from which data will be read in the remote PLC
Word 13, Word 14	Remote reference table read location starting address	1-based offset in the remote PLC
Word 15	Remote reference table length (in remote memory units)	Number of remote memory units to be read.
Word 16	Network address type	Must be 1. Indicates an IP address will be used.
Word 17	Network address length	Must be 4 for IP address. Group ID (multicast) is not permitted.
Word 18 – Word 21	IP Address of the remote PLC	Four integers, specified as one integer per word of the dotted-decimal IP address of the remote PLC. May not be a group IP address.
Word 22	Password length, required	Number of data bytes in the optional password. Must be set to 0 if a password is not included.
Word 23 – end	Password, optional	Password data (optional). This is the optional password that may be required to access the remote server.

* Word 4 (COMMREQ status word address) is the only zero-based address in the Command Block. Only this value requires subtracting 1 from the intended address.

(Word 7) EGD Command Number: Word 7 requests that a read PLC memory operation occur. If the command is processed successfully, it will result in PLC reference memory data being retrieved from the server to the client.

(Word 8) Read Command Timeout: Word 8 specifies the time (in milliseconds) the Ethernet interface will wait for the command to complete before returning an error status in the COMMREQ status word. If the timeout is specified as zero, no timeout error will be reported.

(Word 9) Local PLC - Memory Type: Words 9-11 specify the location in the local PLC where the Ethernet interface will store data received from the remote PLC. Valid values for Word 9 are listed below. The amount of data to be transferred is specified by the number of memory units of the data read from the remote PLC (Word 15).

Type	*Value (Decimal)*	*Description*
%R	8	Register memory (word mode)
%AI	10	Analog input memory (word mode)
%AQ	12	Analog output memory (word mode)
%I	16 70	Discrete input memory (byte mode) Discrete input memory (bit mode)
%Q	18 72	Discrete output memory (byte mode) Discrete output memory (bit mode)
%T	20 74	Discrete temporary memory (byte mode) Discrete temporary memory (bit mode)
%M	22 76	Discrete momentary internal memory (byte mode) Discrete momentary internal memory (bit mode)
%SA	24 78	Discrete system memory group A (byte mode) Discrete system memory group A (bit mode)
%SB	26 80	Discrete system memory group B (byte mode) Discrete system memory group B (bit mode)
%SC	28 82	Discrete system memory group C (byte mode) Discrete system memory group C (bit mode)
%S †	30 84	Discrete system memory (byte mode) Discrete system memory (bit mode)
%G	56 86	Discrete global data table (byte mode) Discrete global data table (bit mode)

† Read-only memory, cannot be written to.

(Words 10 - 11) Local PLC - Memory Starting Address: Words 10 and 11 determine the starting address in the local PLC in which the data from the remote PLC is to be stored. The value entered is the 32-bit offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 9. Word 10 contains the least significant 16 bits of the offset; word 11 contains the most significant 16 bits of the offset. This offset will be either in bits, bytes, or words depending on the mode specified. (For example, if Word 9=16 and Words 10,11 = 2, 0 then the starting address will be %I9.) Valid ranges of values depend on the PLC's memory ranges. The user is responsible for assuring that this area is large enough to contain the requested data without overwriting other application data.

(Word 12) Remote PLC - Memory Type: Words 12–14 specify the memory type and starting address in the remote PLC from which the data is to be read. Valid values for Word 12 are listed above. (Note: The CPU374 cannot access %W memory on any remote device.)

(Words 13 - 14) Remote PLC - Memory Starting Address: Words 13,14 determine the starting address in the remote PLC from which the data is to be read. The value entered is the 32-bit offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 12. Word 13 contains the least significant 16 bits of the offset; word 14 contains the most significant 16 bits of the offset. This offset will be either in bits, bytes, or words depending on the mode specified (for example, if Word 12=16 and Words 13,14 =9, 0, then the starting address will be %I65). Valid ranges of values depend on the remote PLC's memory ranges.

(Word 15) Remote PLC - Number of Memory Units: Word 15 specifies the amount of data to be transferred. The value entered is the number of memory units to be transferred, where the size of the remote PLC memory type (bit, byte, or word) is specified in Word 12. For example, if Word 12=16 and Word 15=4, then 4 bytes (32 bits) of %I memory will be transferred. For Read PLC Memory, the maximum length is 11200 bits, 1400 bytes, or 700 words of data.

(Word 16) Remote PLC - Network Address Type: Word 16 specifies the format of the remote PLC address. Word 16 must contain the value 1. This indicates a dotted-decimal IP address expressed using a separate register for each decimal digit.

(Word 17) Remote PLC - Network Address Length: Word 17 specifies the length in words of the remote PLC IP address in this COMMREQ Command Block. Word 17 must contain 4.

(Words 18 – 21) Remote PLC - IP Address: Words 18–21 specify the four integers, one integer per word, of the dotted-decimal IP address of the remote PLC to be accessed.

(Word 22) Remote PLC – Password Length: Word 22 specifies the number of bytes of data in the optional password field of this COMMREQ. The maximum password length is 254 bytes. If a password is not included, word 22 must be set to 0.

Note

The total COMMREQ data block length in Word 1 must include the optional password data, expressed as a number of words. To convert the password length to a word value, simply add 1 to the byte value in Word 22 and divide the sum by 2.

Words 23 …) Remote PLC – Password (Optional): Words 23 through the end of the COMMREQ Command Block specify optional password data to be passed to the remote server. The format and content of the password data is dependent upon the particular remote server.

Note

The Read PLC Memory command can only be sent to a GE Fanuc PLC server.

For a GE Fanuc PLC server, the password data must contain a case-sensitive ASCII string of 0 to 7 characters followed by a terminating NULL character. The password string must have each pair of ASCII characters reversed within the PLC memory. For example, the password string “MARY” (“M” = 4DH, “A” = 41H, “R” = 52H, “Y” = 59H) would have 414DH in the first word, 5952H in the second word, and 0000H in the third word (the terminating NULL character) The password length in Word 22 would be 0005H. (The password data occupies 3 words, so the COMMREQ Data Block length in Word 1 would be 16+3 = 19 words.)

Write PLC Memory (4001)

The Write PLC Memory command can be used to write memory locations to one remote PACSystems PLC. Use of this command does not require a configured produced / consumed exchange in the PLCs.

Write PLC Memory Command Block

Word Offset	Value	Description
Word 1	Length of command data block, including optional password data	16 plus number of words of optional password data. (See Word 22 description.)
Word 2	0	Always 0 (no-wait mode request)
Word 3	(See table on page 5-3)	Memory type of COMMREQ Status Word
Word 4	0-based.	Offset of COMMREQ Status Word
Word 5	0	Reserved
Word 6	0	Reserved
Word 7	4001 (fa1H)	Write PLC Memory command number.
Word 8	Timeout, in milliseconds	The maximum time to wait for a response, in 10-millisecond increments. Default is 1000ms. A timeout must be specified. If 0 is entered, the default of 1000ms is used.
Word 9	Local write buffer memory type	Memory type for the data that will be written, in the local PLC.
Word 10, Word 11	Local write buffer reference table starting address	1-based offset in the local PLC.
Word 12	Remote write location memory type	Memory type into which data will be written in the remote PLC(s)
Word 13, Word 14	Remote reference table write location starting address	1-based offset in the remote PLC
Word 15	Write Length	0 to 1400 bytes, 0 to 700 words.
Word 16	Network address type	Must be 1. Indicates an IP address will be used.
Word 17	Network address length	Must be 4 for IP address. Group ID (multicast) is not permitted.
Word 18 – Word 21	IP Address of the remote PLC	Four integers, specified as one integer per word of the dotted-decimal IP address of the remote PLC. May not be a group IP address.
Word 22	Password length, required	Number of data bytes in the optional password. Must be set to 0 if a password is not included.
Word 23 – end	Password, optional	Password data (optional). This is the optional password that may be required to access the remote server.

* Word 4 (CRS word address) is the only zero-based address in the Command Block. Only this value requires subtracting 1 from the intended address.

(Word 7) EGD Command Number: Word 7 requests that a write PLC memory operation occur. If the command is processed successfully, PLC reference memory data is sent from the server to the client.

(Word 8) Write Command Timeout: Word 8 specifies the time (in milliseconds) that the Ethernet interface waits for the command to complete before returning an error status in the COMMREQ status word. If the timeout value is specified as zero, no timeout error is reported.

(Word 9) Local PLC - Memory Type: Words 9-11 specify the location in the local PLC where the Ethernet interface obtains the data to be written to the remote PLC. Valid values for Word 9 are listed in the description of Read PLC Memory Command. The amount of data to be transferred is specified by the number of memory units of the data written to the remote PLC (Word 15).

(Words 10 - 11) Local PLC - Memory Starting Address: Words 10 and 11 determine the starting address in the local PLC from which the data is written to the remote PLC. The value entered is the 32-bit offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 9. Word 10 contains the least significant 16 bits of the offset; word 11 contains the most significant 16 bits of the offset. This offset is in bits, bytes, or words depending on the mode specified. (For example, if Word 9=16 and Words 10,11 = 2, 0 then the starting address will be %I9.) Valid ranges of values depend on the PLC's memory ranges.

(Word 12) Remote PLC - Memory Type: Words 12–14 specify the memory type and starting address in the remote PLC where data is to be written. Valid values for Word 12 are listed above. (Note: The CPU374 *PLUS* cannot access %W memory on any remote device.)

(Words 13 - 14) Remote PLC - Memory Starting Address: Words 13,14 determine the starting address in the remote PLC where data is to be written. The value entered is the 32-bit offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 12. Word 13 contains the least significant 16 bits of the offset; word 14 contains the most significant 16 bits of the offset. This offset is in bits, bytes, or words depending on the mode specified (for example, if Word 12=16 and Words 13,14 =9, 0, the starting address will be %I65). Valid ranges of values depend on the remote PLC's memory ranges.

(Word 15) Remote PLC - Number of Memory Units: Word 15 specifies the amount of data to be transferred. The value entered is the number of memory units to be transferred, where the size of the remote PLC memory type (bit, byte, or word) is specified in Word 12. For example, if Word 12=16 and Word 15=4, then 4 bytes (32 bits) of %I memory will be transferred. For Write PLC Memory, the maximum length is 11200 bits, 1400 bytes, or 700 words of data. If a password is specified, the data length is decreased by the password length plus 8 bytes.

(Word 16) Remote PLC - Network Address Type: Word 16 specifies the format of the remote PLC address. Word 16 must contain the value 1. This indicates a dotted-decimal IP address expressed using a separate register for each decimal digit.

(Word 17) Remote PLC - Network Address Length: Word 17 specifies the length in words of the remote PLC IP address in this COMMREQ Command Block. Word 17 must contain 4.

(Words 18 – 21) Remote PLC - IP Address: Words 18–21 specify the four integers, one integer per word, of the dotted-decimal IP address of the remote PLC to be accessed.

(Word 22) Remote PLC – Password Length: Word 22 specifies the number of bytes of data in the optional password field of this COMMREQ. The maximum password data length is 254 bytes. If a password is not included, word 22 must be set to 0.

Note

The total COMMREQ data block length in Word 1 must include the optional password data, expressed as a number of words. To convert the password length to a word value, simply add 1 to the byte value in Word 22 and divide the sum by 2.

(Words 23 …) Remote PLC – Password (Optional): Words 23 through the end of the COMMREQ Command Block specify optional password data to be passed to the remote server. The format and content of the password data is dependent upon the particular remote server.

Note

The Write PLC Memory command can only be sent to a GE Fanuc PLC server.

For a GE Fanuc PLC server, the password data must contain a case-sensitive ASCII string of 0 to 7 characters followed by a terminating NULL character. The password string must have each pair of ASCII characters reversed within the PLC memory. For example, the password string “MARY” (“M” = 4DH, “A” = 41H, “R” = 52H, “Y” = 59H) would have 414DH in the first word, 5952H in the second word, and 0000H in the third word (the terminating NULL character) The password length in Word 22 would be 0005H. (The password data occupies 3 words, so the COMMREQ Data Block length in Word 1 would be 16+3 = 19 words.)

Read EGD Exchange (4002)

The Read EGD Exchange command can be used to read some or all of a configured Ethernet Global Data exchange from either the producer or the consumer. This command identifies the data to be read using its configured Producer ID and Exchange ID. It can then read the content of the data for the exchange, directly from the producer or consumer device memory. This command can be sent to other CPU374 *PLUS* modules with enhanced Ethernet interface, PACSystems PLCs and to other EGD Class 2 devices. In a CPU374 *PLUS*, reading an EGD exchange reads the PLC reference memory locations configured to be transferred at the specified offset in the exchange. Thus current process data is read, not the data that was transferred last in the exchange.

Read EGD Exchange Command Block

Word Offset	Value	Description
Word 1	Length of command data block, including optional password data	19 plus number of words of optional password data. (See Word 25 description.)
Word 2	0	Always 0 (no-wait mode request)
Word 3	(See table on page 5-3)	Memory type of COMMREQ Status Word
Word 4	0-based.	Offset of COMMREQ Status Word
Word 5	0	Reserved
Word 6	0	Reserved
Word 7	4002 (fa2H)	Read EGD Exchange command number.
Word 8	Timeout, in milliseconds	The maximum time to wait for a response, in 10-millisecond increments. Default is 1000ms. A timeout must be specified. If 0 is entered, the default of 1000ms is used.
Word 9	Local read buffer memory type	Memory type for the data, in the local PLC.
Word 10, 11	Local read buffer reference table starting address	1-based offset
Word 12	Remote signature	EGD Exchange signature. This should be 0 for PLCs.
Word 13, 14	Remote Producer ID	EGD Producer ID
Word 15, 16	Remote Exchange ID	EGD Exchange ID
Word 17	Remote Exchange Offset	Byte offset (0-based) in the exchange that should be read.
Word 18	Read length	Number of bytes to be read in the range 0 to 1400 bytes.
Word 19	Network address type	Must be 1. Indicates that an IP address will be used.
Word 20	Network address length	Must be 4 for IP address. Group ID (multicast) is not permitted.
Word 21 to Word 24	IP Address of the remote PLC	Four integers, specified as one integer per word of the dotted-decimal IP address of the remote PLC. May not be a group IP address.
Word 25	Password length, required	Number of data bytes in the optional password. Must be set to 0 if a password is not included.
Word 26 – end	Password, optional	Password data (optional). This is the optional password that may be required to access the remote server.

* Word 4 (COMMREQ status word address) is the only zero-based address in the Command Block. Only this value requires subtracting 1 from the intended address.

(Word 7) EGD Command Number: Word 7 requests that a read EGD exchange operation occur. If the command is processed successfully, it will result in data from a specified EGD exchange being read from the client to the server.

(Word 8) Read Command Timeout: Word 8 specifies the time (in milliseconds) the Ethernet Interface should wait for the command to complete before returning an error status in the COMMREQ status word. If the timeout value is specified as zero, a timeout of 1000 msec (= 1.000 sec) is used.

(Word 9) Local PLC - Memory Type: Words 9-11 specify the location in the local PLC where the Ethernet interface obtains the data to be read from the remote EGD device. Valid values for Word 9 are listed in the description of Read PLC Memory Command. The amount of data to be transferred is specified by the Exchange Data Length (Word 18).

(Words 10 - 11) Local PLC - Memory Starting Address: Words 10 and 11 determine the starting address in the local PLC where data is read from the remote EGD exchange. The value entered is the 32-bit offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 9. Word 10 contains the least significant 16 bits of the offset; word 11 contains the most significant 16 bits of the offset. This offset is in bits, bytes, or words depending on the mode specified. (For example, if Word 9=16 and Words 10,11 = 2, 0 the starting address is %I9.) Valid ranges of values depend on the PLC's memory ranges. The user is responsible for assuring that this area is large enough to contain the requested data without overwriting other application data.

(Word 12) Remote EGD exchange – Exchange Signature: Words 12 contains the 16-bit exchange signature value to be compared at the remote EGD device. For remote PLC's, the exchange signature should ordinarily be set to 0.

(Words 13 - 14) Remote EGD exchange – Producer ID: Words 13 and 14 contains the 32-bit Producer ID of the desired exchange at the remote EGD device. Word 13 contains the least significant 16 bits of the Producer ID; word 14 contains the most significant 16 bits.

(Words 15 - 16) Remote EGD exchange – Exchange ID: Words 15 and 16 contains the 32-bit Exchange ID of the desired exchange at the remote EGD device. Word 15 contains the least significant 16 bits of the Exchange ID; word 16 contains the most significant 16 bits.

(Word 17) Remote EGD exchange – Exchange Data Offset: Word 17 contains the 0-based byte offset of the data to be read from the data portion of the exchange at the remote EGD device.

(Word 18) Remote EGD exchange – Exchange Data Length: Word 18 contains the length (in bytes) of the exchange data to be read from the remote EGD device. The exchange data length may not exceed 1400 bytes.

(Word 19) Remote Server - Network Address Type: Word 19 specifies the format of the remote PLC address. Word 19 must contain the value 1. This indicates a dotted-decimal IP address expressed using a separate register for each decimal digit.

(Word 20) Remote Server - Network Address Length: Word 20 specifies the length in words of the remote PLC IP address in this COMMREQ Command Block. Word 20 must contain 4.

(Words 21 – 24) Remote Server - IP Address: Words 21–24 specify the four integers, one integer per word, of the dotted-decimal IP address of the remote PLC to be accessed.

(Word 25) Remote Server– Password Length: Word 25 specifies the number of bytes of data in the optional password field of this COMMREQ. The maximum password length is 254 bytes. If a password is not included, word 25 must be set to 0.

Note

The total COMMREQ data block length in Word 1 must include the optional password data, expressed as a number of words. To convert the password length to a word value, simply add 1 to the byte value in Word 25 and divide the sum by 2.

(Words 26 …) Remote Server– Password (Optional): Words 26 through the end of the COMMREQ Command Block specify optional password data to be passed to the remote server. The format and content of the password data is dependent upon the particular remote server.

Note

The Read EGD Exchange command can be sent to various servers.

For a GE Fanuc PLC server, the password data must contain a case-sensitive ASCII string of 0 to 7 characters followed by a terminating NULL character. The password string must have each pair of ASCII characters reversed within the PLC memory. For example, the password string “MARY” (“M” = 4DH, “A” = 41H, “R” = 52H, “Y” = 59H) would have 414DH in the first word, 5952H in the second word , and 0000H in the third word (the terminating NULL character) The password length in Word 22 would be 0005H. (The password data occupies 3 words, so the COMMREQ Data Block length in Word 1 would be 19+3 = 22 words.)

Write EGD Exchange (4003)

The Write EGD Exchange command can be used to write portions of a configured Ethernet Global Data exchange in a remote producer node. EGD protocol prohibits writing to a consumed exchange. . This command identifies the exchange to be written using its configured Producer ID and Exchange ID. It can then write the content of that data directly to the device memory. This command can be sent to Series 90-30 CPU374 *PLUS*, to PACSystems PLCs and to other EGD Class 2 devices. In a CPU374 *PLUS*, writing an EGD exchange modifies the PLC reference memory locations configured for transfer at the specified offset in the exchange. Thus current process data is updated, not the data that was transferred last in the exchange.

Write EGD Exchange Command Block

Word Offset	Value	Description
Word 1	Length of command data block, including optional password data	19 plus number of words of optional password data. (See Word 25 description.)
Word 2	0	Always 0 (no-wait mode request)
Word 3	(See table on page 5-3)	Memory type of COMMREQ Status Word
Word 4	0-based.	Offset of COMMREQ Status Word
Word 5	0	Reserved
Word 6	0	Reserved
Word 7	4003 (fa3H)	Write EGD Exchange command number.
Word 8	Timeout, in milliseconds	The maximum time to wait for a response, in 10-millisecond increments. Default is 1000ms. A timeout must be specified. If 0 is entered, the default of 1000ms is used.
Word 9	Local write buffer memory type	Memory type for the data, in the local PLC.
Word 10, Word 11	Local write buffer reference table starting address	1-based offset
Word 12	Remote signature	EGD Exchange signature. This should be 0 for PLCs.
Word 13, Word 14	Remote Producer ID	EGD Producer ID
Word 15, Word 16	Remote Exchange ID	EGD Exchange ID
Word 17	Remote Exchange Offset	Byte offset (0-based) in the exchange that should be read.
Word 18	Write length	Number of bytes to be written in the range 0 to 1400 bytes.
Word 19	Network address type	Must be 1. Indicates an IP address will be used.
Word 20	Network address length	Must be 4 for IP address. Group ID (multicast) is not permitted.
Word 21 to Word 24	IP Address of the remote PLC	Four integers, specified as one integer per word of the dotted-decimal IP address of the remote PLC. May not be a group IP address.
Word 25	Password length, required	Number of data bytes in the optional password. Must be set to 0 if a password is not included.
Word 26 – end	Password, optional	Password data (optional). This is the optional password that may be required to access the remote server.

* Word 4 (COMMREQ status word address) is the only zero-based address in the Command Block. Only this value requires subtracting 1 from the intended address.

(Word 7) EGD Command Number: Word 7 requests that a write EGD exchange operation occur. If the command is processed successfully, data for a specified EGD exchange is written from the client to the server.

(Word 8) Write Command Timeout: Word 8 specifies the time (in milliseconds) that the Ethernet interface should wait for the command to complete before returning an error status in the COMMREQ status word. If the timeout value is specified as zero, a timeout of 1000 msec (= 1.000 sec) is used.

(Word 9) Local PLC - Memory Type: Words 9-11 specify the location in the local PLC where the Ethernet Interface will get the data to write to the remote EGD device. Valid values for Word 9 are listed in the description of Read PLC Memory Command. The amount of data to be transferred is specified by the Exchange Data Length (Word 18).

(Words 10 - 11) Local PLC - Memory Starting Address: Words 10 and 11 determine the starting address in the local PLC from which data is to be written to the remote EGD exchange. The value entered is the 32-bit offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 9. Word 10 contains the least significant 16 bits of the offset; word 11 contains the most significant 16 bits of the offset. This offset will be either in bits, bytes, or words depending on the mode specified. (For example, if Word 9=16 and Words 10,11 = 2, 0 then the starting address will be %I9.) Valid ranges of values depend on the PLC's memory ranges.

(Word 12) Remote EGD exchange – Exchange Signature: Words 12 contains the 16-bit exchange signature value to be compared at the remote EGD device. For remote PLC's, the exchange signature should ordinarily be set to 0.

(Words 13 - 14) Remote EGD exchange – Producer ID: Words 13 and 14 contains the 32-bit Producer ID of the desired exchange at the remote EGD device. Word 13 contains the least significant 16 bits of the Producer ID; word 14 contains the most significant 16 bits.

(Words 15 - 16) Remote EGD exchange – Exchange ID: Words 15 and 16 contains the 32-bit Exchange ID of the desired exchange at the remote EGD device. Word 15 contains the least significant 16 bits of the Exchange ID; word 16 contains the most significant 16 bits. For the Write EGD Command, the exchange at the remote device must be a Produced exchange.

(Word 17) Remote EGD exchange – Exchange Data Offset: Word 17 contains the 0-based byte offset of the data to be overwritten in the data portion of the exchange at the remote EGD device.

(Word 18) Remote EGD exchange – Exchange Data Length: Word 18 contains the length (in bytes) of the exchange data to be written to the remote EGD device. The exchange data length may not exceed 1400 bytes.

(Word 19) Remote Server - Network Address Type: Word 19 specifies the format of the remote PLC address. Word 19 must contain the value 1. This indicates a dotted-decimal IP address expressed using a separate register for each decimal digit.

(Word 20) Remote Server - Network Address Length: Word 20 specifies the length in words of the remote PLC IP address in this COMMREQ Command Block. Word 20 must contain 4.

(Words 21 – 24) Remote Server - IP Address: Words 21–24 specify the four integers, one integer per word, of the dotted-decimal IP address of the remote PLC to be accessed.

(Word 25) Remote Server– Password Length: Word 25 specifies the number of bytes of data in the optional password field of this COMMREQ. The maximum password length is 254 bytes. If a password is not included, word 25 must be set to 0.

Note

The total COMMREQ data block length in Word 1 must include the optional password data, expressed as a number of words. To convert the password length to a word value, simply add 1 to the byte value in Word 25 and divide the sum by 2.

(Words 26 …) Remote Server– Password (Optional): Words 26 through the end of the COMMREQ Command Block specify optional password data to be passed to the remote server. The format and content of the password data is dependent upon the particular remote server.

Note

The Write EGD Exchange command can be sent to various servers.

For a GE Fanuc PLC server, the password data must contain a case-sensitive ASCII string of 0 to 7 characters followed by a terminating NULL character. The password string must have each pair of ASCII characters reversed within the PLC memory. For example, the password string “MARY” (“M” = 4DH, “A” = 41H, “R” = 52H, “Y” = 59H) would have 414DH in the first word, 5952H in the second word , and 0000H in the third word (the terminating NULL character) The password length in Word 22 would be 0005H. (The password data occupies 3 words, so the COMMREQ Data Block length in Word 1 would be 19+3 = 22 words.)

Masked Write to EGD Exchange (4004)

The Masked Write to EGD Exchange command can be used to write one or more bits in a single byte of a configured Ethernet Global Data exchange in a remote producer node. EGD protocol prohibits writing to a consumed exchange. This command can be sent to Series 90-30 CPU374 *PLUS*, and to PACSystems PLCs and to other EGD Class 2 devices.

In a CPU374 *PLUS*, writing an EGD exchange modifies the PLC reference memory locations configured to be transferred at the specified offset in the exchange. Thus current process data is updated, not the data that was transferred last in the exchange.

Masked Write EGD Exchange Command Block

Word Offset	Value	Description
Word 1	Length of command data block, including optional password data	17 plus number of words of optional password data. (See Word 17 description.)
Word 2	0	Always 0 (no-wait mode request)
Word 3	(See table on page 5-3)	Memory type of COMMREQ Status Word
Word 4	0-based.	Offset of COMMREQ Status Word
Word 5	0	Reserved
Word 6	0	Reserved
Word 7	4004 (fa4H)	Masked Write to EGD Exchange command number.
Word 8	Timeout, in milliseconds	The maximum time to wait for a response, in 10-millisecond increments. Default is 1000ms. A timeout must be specified. If 0 is entered, the default of 1000ms is used.
Word 9	Bit mask, set bit to be written to 1, rest to 0	The bit mask selects the individual bit to be written. The most significant bytes of Word 9 and Word 10 are ignored.
Word 10	Write 0 or 1 to selected bit.	Value to set the bit selected by the bit mask in Word 9.
Word 11	Remote signature	EGD Exchange signature. This should be 0 for PLCs.
Word 12, 13	Remote Producer ID	EGD Producer ID
Word 14, 15	Remote Exchange ID	EGD Exchange ID
Word 16	Remote Exchange Offset	Byte offset (0-based) in the exchange that should be read.
Word 17	Network address type	Must be 1. Indicates an IP address will be used.
Word 18	Network address length	Must be 4 for IP address. Group ID (multicast) is not permitted.
Word 19 to Word 22	IP Address of the remote PLC	Four integers, specified as one integer per word of the dotted-decimal IP address of the remote PLC. May not be a group IP address.
Word 23	Password length, required	Number of data bytes in the optional password. Must be set to 0 if a password is not included.
Word 24 – end	Password, optional	Password data (optional). This is the optional password that may be required to access the remote server.

* Word 4 (COMMREQ status word address) is the only zero-based address in the Command Block. Only this value requires subtracting 1 from the intended address.

(Word 7) EGD Command Number: Word 7 requests that a masked write EGD exchange operation occur. If the command is processed successfully, a data bit for a specified EGD exchange is written from the client to the server.

(Word 8) Masked Write Command Timeout: Word 8 specifies the time (in milliseconds) that the Ethernet interface should wait for the command to complete before returning an error status in the COMMREQ status word. If the timeout value is specified as zero, a timeout of 1000 msec (= 1.000 sec) is used.

(Word 9) Bit Mask: Words 9 – 10 specify the individual data to be written to the remote EGD exchange. The usage of the Bit Mask and Data are described in *Masked Write to EGD Exchange Bit Mask and Data Bits*, below. Word 9 contains a bit mask that identifies a bit or bits within a data byte. The mask bit corresponding to each data bit to be written is set to 1; all other bits are set to 0.

(Word 10) Data: Word 10 contains the data byte that contains the bit or bits to be written to the remote EGD exchange. The individual data bits to be written are in the same position as the 1 bits in the Bit Mask (Word 9).

(Word 11) Remote EGD exchange – Exchange Signature: Words 11 contains the 16-bit exchange signature value to be compared at the remote EGD device. For remote PLC's, the exchange signature should ordinarily be set to 0.

(Words 12 - 13) Remote EGD exchange – Producer ID: Words 12 and 13 contains the 32-bit Producer ID of the desired exchange at the remote EGD device. Word 12 contains the least significant 16 bits of the Producer ID; word 13 contains the most significant 16 bits.

(Words 14 - 15) Remote EGD exchange – Exchange ID: Words 14 and 15 contains the 32-bit Exchange ID of the desired exchange at the remote EGD device. Word 14 contains the least significant 16 bits of the Exchange ID; word 15 contains the most significant 16 bits. For the Masked Write EGD Command, the exchange at the remote device must be a Produced exchange.

(Word 16) Remote EGD exchange – Exchange Data Offset: Word 16 contains the 0-based byte offset of the single data byte data containing the bit or bits to be overwritten in the data portion of the exchange at the remote EGD device.

(Word 17) Remote Server - Network Address Type: Word 17 specifies the format of the remote PLC address. Word 17 must contain the value 1. This indicates a dotted-decimal IP address expressed using a separate register for each decimal digit.

(Word 18) Remote Server - Network Address Length: Word 18 specifies the length in words of the remote PLC IP address in this COMMREQ Command Block. Word 18 must contain 4.

(Words 19 – 22) Remote Server - IP Address: Words 19–22 specify the four integers, one integer per word, of the dotted-decimal IP address of the remote PLC to be accessed.

(Word 23) Remote Server– Password Length: Word 23 specifies the number of bytes of data in the optional password field of this COMMREQ. The maximum password length is 254 bytes. If a password is not included, word 23 must be set to 0.

Note

The total COMMREQ data block length in Word 1 must include the optional password data, expressed as a number of words. To convert the password length to a word value, simply add 1 to the byte value in Word 23 and divide the sum by 2.

(Words 24 …) Remote Server– Password: Words 24 through the end of the COMMREQ Command Block specify optional password data to be passed to the remote server. The format and content of the password data is dependent upon the particular remote server.

Note

The Masked Write to EGD Exchange command can be sent to various servers.

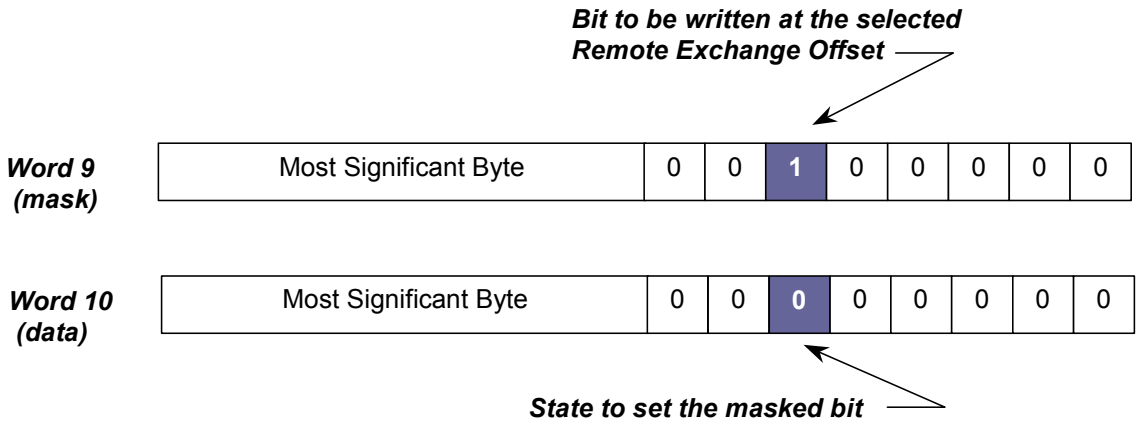
For a GE Fanuc PLC server, the password data must contain a case-sensitive ASCII string of 0 to 7 characters followed by a terminating NULL character. The password string must have each pair of ASCII characters reversed within the PLC memory. For example, the password string “MARY” (“M” = 4DH, “A” = 41H, “R” = 52H, “Y” = 59H) would have 414DH in the first word, 5952H in the second word , and 0000H in the third word (the terminating NULL character) The password length in Word 22 would be 0005H. (The password data occupies 3 words, so the COMMREQ Data Block length in Word 1 would be 17+3 = 20 words.)

Masked Write to EGD Exchange Bit Mask and Data Bits

Word 9 of the Masked Write command contains the bit mask. The most significant byte of Word 9 is ignored. In the least significant byte, any bits set to 1 will be written to the remote producer.

The equivalent bit of Word 10 of the Masked Write command contains the bit state to be written, 1 or 0. The most significant byte of Word 10 is also ignored.

For example:


Bit to be written at the selected
Remote Exchange Offset
Word 9
(mask)
Most Significant Byte
0 0 1 0 0 0 0 0
Word 10
(data)
Most Significant Byte
0 0 0 0 0 0 0 0
State to set the masked bit

Chapter 6 Programming SRTP Channel Commands

This chapter describes how to implement PLC to PLC communications over the Ethernet network using SRTP Channel commands:

- SRTP Channel Commands
  - Channel Operations
  - Aborting and Re-tasking a Channel
  - SRTP Channel Commands in a Redundant System
  - Executing a Channel Command
- COMMREQ Format for Programming Channel Commands
  - Establish Read Channel
  - Establish Write Channel
  - Send Information Report
  - Abort Channel
  - Retrieve Detailed Channel Status
- Programming for Channel Commands
  - COMMREQ Example
  - Sequencing Communications Requests
  - Managing Channels and TCP Connections
  - Use Channel Re-Tasking to Avoid using up TCP Connections
  - Client Channels TCP Resource Management
  - SRTP Application Timeouts
- Monitoring Channel Status
- New Features of SRTP Channels

SRTP Channel commands are supported by the enhanced CPU374 *PLUS* Ethernet interface. This feature is not available in CPU374 versions prior to Release 12.00.

SRTP Channel Commands

The SRTP Channel commands are a set of client PLC commands that can be used to communicate with a server PLC.

A Channel command can establish a channel to execute multiple *periodic* reads or writes with a single initiation of a COMMREQ function. A Channel command can also be used to execute a single read or write.

There are five Channel commands:

- Establish Read Channel
- Establish Write Channel
- Send Information Report
- Abort Channel
- Retrieve Detailed Channel Status

Up to 16 simultaneous SRTP channels (1–16) can be established by a CPU374 *PLUS* Ethernet interface. Channels can be individually monitored from the application program. Each SRTP channel can accommodate data transfers of up to 1KB. (The total number of SRTP channels is independent of the number of SRTP Server connections.)

Channel Operations

Channel commands are based on the concept of periodic data transfers. The client (local) PLC uses a single COMMREQ function to establish a channel (connection) to a server (remote) PLC and to request that specific data be periodically transferred between the PLCs.

The Ethernet interface automatically manages the establishment of communications and the periodic data transfer. Parameters in the Command Block specify the frequency and direction of the transfer, and the memory locations in the client and server to be used in the transfer.

Aborting and Re-tasking a Channel

There are four ways a channel can be aborted:

1. When the PLC CPU is stopped, all channels in use are aborted automatically.
2. A channel (or all channels) can be aborted by issuing an Abort Channel command.
3. A channel in use can be re-tasked by issuing an establish command for its channel number. This aborts the previous channel operation and then performs the new channel operation.
4. A channel is also automatically aborted if a fatal error occurs.

Monitoring the Channel Status

The Ethernet Interface status bits occupy a single block of memory. The memory location is specified during configuration of the Ethernet interface. The status bits are updated in the CPU once each PLC scan by the Ethernet interface. These bits are generally used to prevent initiation of a COMMREQ function when certain errors occur or to signal a problem on an established channel.

The first 16 bits of the block are the LAN Interface Status (LIS) bits. The next 32 bits are the Channel Status bits (2 for each channel). Bits 49-80 are reserved. Unless the "LAN Interface OK" bit is set (Status Bit 16), the other status bits are invalid.

Status Bits	*Brief Description*
1	Port 1 full duplex
2	Port 1 100Mbps
3	Port 2 full duplex
4	Port 2 100 Mbps
5-8	Reserved
9	Any Channel Error (error on any channel)
10–12	Reserved
13	LAN OK
14	Resource problem
15	Module Overtemperature (RX3i only)
16	LAN Interface OK
17	Data Transfer - Channel 1
18	Channel Error - Channel 1
...	...
47	Data Transfer - Channel 16
48	Channel Error - Channel 16
49-80	Reserved

The LAN Status bits (bits 1 – 16) are described in chapter 9, Diagnostics. They monitor the health of the Ethernet interface itself.

Bit 16, LAN interface OK Bit: This bit is set to 1 by the Ethernet interface each PLC scan. If the Ethernet interface cannot access the PLC, the CPU sets this bit to 0. *When this bit is 0, all other Ethernet Interface Status bits are invalid.*

Channel Status Bits

The Channel Status bits provide runtime status information for each communication channel. Each channel has two status bits; the meaning of the channel status bits depends upon the type of communication performed on that channel.

SRTP channels operation provides two Channels Status bits for each SRTP channel, a Data Transfer bit and a Channel Error bit.

Bits 17, 19, 21 ... 47, Data Transfer Bit: Typically, a channel is used to perform repetitive reads or writes. The Data Transfer bit pulses ($0 \rightarrow 1 \rightarrow 0$) each time there is a successful read or write. This can be an indicator to the ladder program to move the most recent data to another location.

The Data Transfer bit is not closely synchronized in time with the transfer. The bit indicates only whether a transfer has occurred during the preceding read or write period. A rising edge on the bit indicating that a transfer has completed successfully does not guarantee that the next transfer has not begun or completed.

After an Establish Channel command, the COMMREQ status word is always updated *before* the Data Transfer bit is set to 1. The Data Transfer bit for a channel is not meaningful until the Ethernet interface updates the COMMREQ status word. Do not use data received from a server until the COMMREQ status word confirming the Read command for that channel is 1 and the Data Transfer bit goes to 1.

Bits 18, 20, 22 ... 48, Channel Error Bit: This bit (normally 0) is the primary indicator for an error on a channel. It indicates any channel error, fatal or non-fatal. It does not necessarily indicate that the channel is idle.

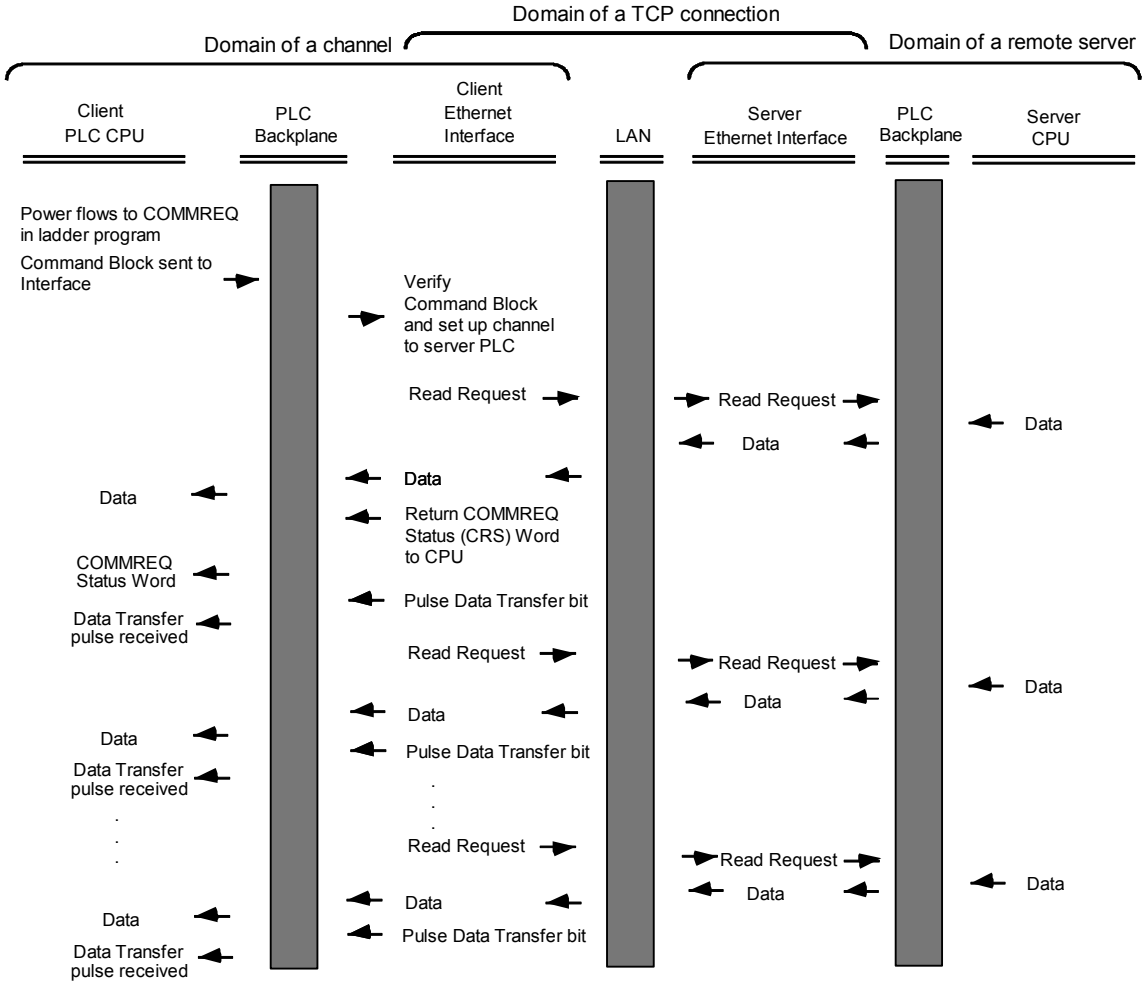
A Channel Error bit is not meaningful until after the Ethernet interface updates the COMMREQ status word confirming the Read or Write command for that channel. For an Establish Channel command, the COMMREQ status word is updated before the Channel Error bit is set to 1.

A Channel Error bit is set to 1 when an error is detected on the channel. It is set to 0 when the channel is initially established and if the channel resumes normal operation after a transient error condition subsides. The Channel Error bit is also set to 0 when the channel is aborted by an Abort Channel command or when the PLC CPU transitions from RUN to STOP. In the case of an Establish Channel command, the COMMREQ status word is always updated *before* the Channel Error bit is set to 1.

If this bit indicates an error, initiate the Abort command and then reinitiate the Read or Write command. If the error persists, initiate the Retrieve Detailed Channel Status command to find out if the channel is idle, and possibly why it is idle. The status code may change between the time the Channel Error bit indicates an error and the time the Retrieve Detailed Channel Status command retrieves the code.

Executing a Channel Command

The figure below shows how a Communications Request carries out a Channel command; in this case, Establish Read Channel.



1. The command starts when there is power flow to a COMMREQ function in the client PLC. At this time, the Command Block data is sent from the to the Ethernet interface.

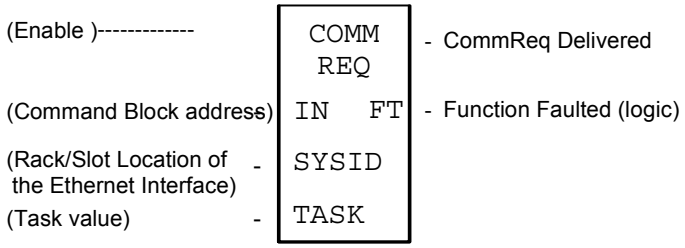
2. For the Establish Read Channel command, the COMMREQ status word is returned immediately if the Command Block is invalid. If the syntax is correct, the COMMREQ status word is returned after the first significant event: upon failure to establish a channel correctly and in a timely manner or upon the first successful transfer of data.

3. After the channel is successfully set up to the server PLC, the Ethernet interface performs the periodic reads as specified in the Command Block.

COMMREQ Format for Programming Channel Commands

The Channel commands described in this chapter are sent using the Communications Request (COMMREQ) function.

The Communications Request is triggered when the logic program passes power to the COMMREQ Function Block.



For the Channel Commands, the parameters of the COMMREQ are:

Enable: Control logic for activating the COMMREQ Function Block.

IN: The location of the Command Block. It can be any valid address within a word-oriented area of (%R, %AI, or %AQ).

SYSID: A hexadecimal word value that gives the rack (high byte) and slot (low byte) location of the CPU module. For the CPU374 *PLUS* embedded Ethernet interface, this must be Rack 0, Slot 1 (= 0001H).

TASK: For the CPU374 *PLUS* Ethernet interface, Task must be set to 21 decimal (= 0015H).

Caution

Entering an incorrect TASK value may cause the Ethernet interface to fail.

FT Output: The FT output is set if the CPU (rather than the Ethernet interface) detects that the COMMREQ fails. In this case, the other status indicators are not updated for this COMMREQ.

The COMMREQ Command Block: General Description

When the COMMREQ function is initiated, the Command Block is sent from the PLC CPU to the Ethernet interface. The Command Block contains the details of a Channel command to be performed by the interface.

The address in CPU memory of the Command Block is specified by the IN input of the COMMREQ Function Block. It can be any valid address within a word-oriented area of

memory (%R, %AI, or %AQ). The Command Block is set up using an appropriate programming instruction, such as a BLOCK MOVE or DATA INIT COMM). The Command Block has the following structure:

Word 1	Data Block Length (words)
Word 2	WAIT/NOWAIT Flag
Word 3	COMMREQ status word Memory Type
Word 4	COMMREQ status word Address Offset
Word 5	*Reserved*
Word 6	*Reserved*
Words 7 and up	Data Block (Channel Command Details)

(Word 1) Data Block Length: This is the length in words of the Data Block portion of the Command Block. The Data Block portion starts at Word 7 of the Command Block. The length is measured from the beginning of the Data Block at Word 7, not from the beginning of the Command Block. The correct value for each command, and the associated length of each command, is specified in the next section.

(Word 2) WAIT/NOWAIT Flag: Must be set to zero for TCP/IP Ethernet communications.

COMMREQ Status Word: The Ethernet interface updates the COMMREQ status word to show success or failure of the command. Command words 3 and 4 specify the PLC memory location of the COMMREQ status word. (COMMREQ Status Word values are described in chapter 9.)

(Word 3) COMMREQ Status Word Memory Type: This word specifies the memory type for the COMMREQ status word. The memory types are listed in the table below:

Type	Value (Decimal)	Value (Hex.)	Description
%R	8	08H	Register memory (word mode)
%AI	10	0AH	Analog input memory (word mode)
%AQ	12	0CH	Analog output memory (word mode)
%I	16 70	10H 46H	Discrete input memory (byte mode) Discrete input memory (bit mode)
%Q	18 72	12H 48H	Discrete output memory (byte mode) Discrete output memory (bit mode)
%T	20 74	14H 4AH	Discrete temporary memory (byte mode) Discrete temporary memory (bit mode)
%M	22 76	16H 4CH	Discrete momentary internal memory (byte mode) Discrete momentary internal memory (bit mode)
%G	56 86	38H 56H	Discrete global data table (byte mode) Discrete global data table (bit mode)

(Word 4) COMMREQ Status Word Address Offset: This word contains the offset within the memory type selected. ***The status word address offset is a zero-based number.*** For example, if you want %R1 as the location of the COMMREQ status word, you must specify a zero for the offset. The offset for %R100 would be 99 decimal. Note, however, that this is the only zero-based field in the Channel commands.

(Word 5): Reserved. Set to zero.

(Word 6): Reserved. Set to zero.

(Words 7 and up) Data Block: The Data Block defines the Channel command to be performed.

Establish Read Channel (2003)

The Establish Read Channel command requests that a channel be associated with a remote PLC and that data from the remote PLC be transferred (periodically) to the local PLC. The Command Block specifies the period, the number of reads from the server (remote PLC) to perform, and the timeout allowed in waiting for each transfer to complete. The first read is performed immediately, regardless of the period specified.

Example Command Block

Establish a channel (Channel 5) to a remote PLC at IP address 10.0.0.1. Return the COMMREQ Status word to %R10. Read remote PLC registers %R50–%R57 to local PLC registers %R100–%R107. Repeat the read 10 times, once every 7 seconds, with a timeout of 500 ms for each read.

*The term **local PLC** is used here to identify the **client PLC**—the PLC that initiates the communications request.*

*The term **remote PLC** is used here to identify the **server PLC**—the PLC that responds to the communications request.*

	Dec (Hex)	
Word 1	00017 (0011)	Length of Channel command Data Block (17–25 words)
Word 2	00000 (0000)	Always 0 (no-wait mode request)
Word 3	00008 (0008)	Memory type of COMMREQ status word (%R)
Word 4	00009 (0009)	COMMREQ status word address minus 1 (%R10)*
Word 5	00000 (0000)	Reserved
Word 6	00000 (0000)	Reserved
Word 7	02003 (07D3)	Establish Read Channel command number
Word 8	00005 (0005)	Channel number (5)
Word 9	00010 (000A)	Number of read repetitions (read 10 times)
Word 10	00003 (0003)	Time unit for read period (3=seconds)
Word 11	00007 (0007)	Number of time units for read period (every 7 seconds)
Word 12	00050 (0032)	Timeout for each read (500 ms)
Word 13	00008 (0008)	Local PLC - Memory type at which to store data (%R)
Word 14	00100 (0064)	Local PLC - Starting address at which to store data (%R100)
Word 15	00008 (0008)	Remote PLC - Memory type from which to read data (%R)
Word 16	00050 (0032)	Remote PLC - Starting address from which to read data (%R50)
Word 17	00008 (0008)	Remote PLC - Number of memory units (8 registers)
Word 18	00001 (0001)	Remote PLC - Network Address type (IP Address)
Word 19	00004 (0004)	Remote PLC - Network Address length in words (4)
Word 20	00010 (000A)	Remote PLC - Register 1 of IP address (10)
Word 21	00000 (0000)	Remote PLC - Register 2 of IP address (0)
Word 22	00000 (0000)	Remote PLC - Register 3 of IP address (0)
Word 23	00001 (0001)	Remote PLC - Register 4 of IP address (1)
Word 24–27		Remote PLC - Program Name (needed for access to remote %P or %L) (zero-terminated and padded)
Word 28–31		Remote PLC - Program Block (needed for access to remote %L) (zero-terminated and padded)

* Word 4 (COMMREQ status word address) is the only zero-based address in the Command Block. Only this value requires subtracting 1 from the intended address.

(Word 7) Channel Command Number: Word 7 requests that a read channel be set up. If the command is processed successfully, it will result in attempting the specified number of transfers from the server to the client.

(Word 8) Channel Number: Word 8 specifies the channel to be used for the read. This value must be in the range of 1–16. If the channel number is out of range, a command error indication will be placed in the COMMREQ Status word. If the channel number is the same as a channel already in use, the channel will be retasked to perform this new command.

(Word 9) Number of Read Repetitions: Word 9 specifies the number of reads to be performed before automatically completing the communications request and closing the channel. If this value is set to 1, only a single read will be issued. If this value is set to 0, reads will be issued continuously on the requested period until the channel is aborted.

(Word 10) Time Unit for Read Period: Words 10–11 together define how often the read is to be performed (*read period*). Word 10 specifies the time unit such as seconds or minutes for the read period. Word 11 specifies the number of those units. The choices for the time units are shown below.

Value	***Meaning***	
1	hundredths of seconds	(10 ms)
2	tenths of seconds	(100 ms)
3	seconds	
4	minutes	
5	hours	

Note: If Time Unit Value is 5 (hours), then the maximum usable value of Number of Time Units is 5965.

(Word 11) Number of Time Units for Read Period: Word 11 specifies the number of time units for the read period. The read period is in effect even when the Channel command is setup to issue a single read.

Example Read Period Calculation: If Word 10 contains a value of 3 specifying seconds as the time unit and Word 11 contains a value of 20, then the read period is 20 seconds.

A Channel command set up to issue a single read can have only one ***pending*** *read transfer.* A read will normally be issued at the start of each read period. If the *pending* read transfer has not completed during the read period, the Channel Error bit and Detailed Channel Status words will be set to indicate a non-fatal period error. The pending transfer can still complete after the period error occurs. For Channel commands set up to issue multiple reads, the next read transfer will be issued only after the pending read transfer completes.

If the Number of Time Units is zero, a subsequent transfer will be issued as soon as the previous transfer completes. In this case, no period errors can occur.

(Word 12) Timeout for Each Read: Word 12 specifies the time (in hundredths of a second) the Ethernet interface will wait for a read transfer to complete before setting the Channel Error bit and Detailed Channel Status words to indicate a non-fatal timeout error. The transfer can still complete even after a timeout occurs. As a result, an application can choose what to do if one occurs. If the timeout value is specified as zero, no timeout errors will be reported.

For most applications a timeout is not needed because the read period acts as a timeout. (Word 12 should be zero for no timeout). However, there are two circumstances in which specifying a timeout is recommended:

- When the number of time units (Word 11) is zero, so that a subsequent transfer will be issued as soon as the previous transfer completes and no period errors are reported. In this case a timeout value can be specified so that timeout errors will be reported by the Channel Error bit.
- When the read period is very long (minutes or hours). In this case a shorter timeout value can be specified so the application doesn't have to wait for the read period to expire before taking action.

(Word 13) Local PLC - Memory Type: Words 13–14 specify the location in the local PLC where the Ethernet interface will store data received from the remote PLC. Valid values for Word 13 are listed below. The amount of data to be transferred is specified by the number of memory units of the data read from the remote PLC (Word 17).

Type	*Value (Decimal)*	*Description*
%L*	0	Program Block Local register memory (word mode)
%P*	4	Program register memory (word mode)
%R	8	Register memory (word mode)
%AI	10	Analog input memory (word mode)
%AQ	12	Analog output memory (word mode)
%I	16 70	Discrete input memory (byte mode) Discrete input memory (bit mode)
%Q	18 72	Discrete output memory (byte mode) Discrete output memory (bit mode)
%T	20 74	Discrete temporary memory (byte mode) Discrete temporary memory (bit mode)
%M	22 76	Discrete momentary internal memory (byte mode) Discrete momentary internal memory (bit mode)
%SA	24 78	Discrete system memory group A (byte mode) Discrete system memory group A (bit mode)
%SB	26 80	Discrete system memory group B (byte mode) Discrete system memory group B (bit mode)
%SC	28 82	Discrete system memory group C (byte mode) Discrete system memory group C (bit mode)
%S †	30 84	Discrete system memory (byte mode) Discrete system memory (bit mode)
%G	56 86	Discrete global data table (byte mode) Discrete global data table (bit mode)

† Read-only memory, cannot be written to.

* Can only be accessed in the Remote PLC

(Word 14) Local PLC - Memory Starting Address: Word 14 determines the starting address in the local PLC in which the data from the remote PLC is to be stored. The value entered is the offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 13. This offset will be either in bits, bytes, or words depending on the mode specified (for example, if Word 13=16 and Word 14=2, then the starting address will be

%I9). Valid ranges of values depend on the PLC's memory ranges. The user is responsible for assuring that this area is large enough to contain the requested data without overwriting other application data.

(Word 15) Remote PLC - Memory Type: Words 15–16 specify the memory type and starting address in the remote PLC from which the data is to be read. Valid values for Word 15 are listed above. If %P memory is used, you must specify a Program name in Words 24–27. If %L memory is used, you must specify a Program name in Words 24 –27 and a Program Block name in Words 28–31.

(Word 16) Remote PLC - Memory Starting Address: Word 16 determines the starting address in the remote PLC from which the data is to be read. The value entered is the offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 15. This offset will be either in bits, bytes, or words depending on the mode specified (for example, if Word 15=16 and Word 16=9, then the starting address will be %I65). Valid ranges of values depend on the remote PLC's memory ranges.

(Word 17) Remote PLC - Number of Memory Units: Word 17 specifies the amount of data to be transferred. The value entered is the number of memory units to be transferred, where the size of a memory unit is a bit, byte, or word as specified in Word 15. For example, if Word 15=16 and Word 17=4, then 4 bytes (32 bits) of %I memory will be transferred. A maximum of 16384 bits, 2048 bytes, or 1024 words of data can be specified.

(Word 18) Remote PLC - Network Address Type: Word 18 specifies the format of the remote PLC address. Word 18 must contain the value 1. This indicates a dotted-decimal IP address expressed using a separate register for each decimal digit.

(Word 19) Remote PLC - Network Address Length: Word 19 specifies the length in words of the remote PLC IP address. Word 19 must contain 4.

(Words 20 – 23) Remote PLC - IP Address: Words 20–23 specify the four integers, one integer per word, of the dotted-decimal IP address of the remote PLC to be accessed.

(Words 24–27) Remote PLC - Program Name: Words 24–27 specify the case-sensitive, zero-terminated and padded program name (also called task name, which can be found through the PROG Station Manager command on the server Ethernet interface) to be used with access to remote %P or %L memory. These words are required only for access to such memory and will be ignored if the Memory Type field is not %P or %L. See Note below.

(Words 28–31) Remote PLC - Program Block Name: Words 28–31 specify the case-sensitive, zero-terminated and padded program block name (which can be found in the program block declaration in the server ladder program) to be used with access to remote %L memory. These words are required only for access to such memory and will be ignored if the Memory Type field is not %P or %L.

> **Note**: The Program Name (Words 24–27) and Program Block Name (Words 28–31) must have each pair of ASCII characters reversed within the PLC memory. For example, the name "MARY" ("M" = 4DH, "A" = 41H, "R" = 52H, "Y" = 59H) would have 414DH in the first word and 5952H in the second word.

Establish Write Channel (2004)

The Establish Write Channel command requests that a channel be connected to a remote PLC and that data from the local PLC be transferred (periodically) to the remote PLC. The Command Block specifies the period, the number of writes to the server (remote PLC) to perform, and the timeout allowed in waiting for each transfer to complete. The first write is performed immediately, regardless of the period specified.

Example Command Block

Establish a write channel (Channel 6) to a remote PLC at IP address 10.0.0.1. Return the COMMREQ Status word to %R10. Write local PLC registers %R50–%R57 to remote PLC registers %R100–%R107. Repeat the write indefinitely, once every 7 seconds, with a timeout of 500 ms for each write.

*The term **local PLC** is used here to identify the **client PLC**—the PLC that initiates the communications request.*

*The term **remote PLC** is used here to identify the **server PLC**—the PLC that responds to the communications request.*

	Dec (Hex)	
Word 1	00017 (0011)	Length of Channel command Data Block (17–25 words)
Word 2	00000 (0000)	Always 0 (no-wait mode request)
Word 3	00008 (0008)	Memory type of COMMREQ status word (%R)
Word 4	00009 (0009)	COMMREQ status word address minus 1 (%R10) *
Word 5	00000 (0000)	Reserved
Word 6	00000 (0000)	Reserved
Word 7	02004 (07D4)	Establish Write Channel command number
Word 8	00006 (0006)	Channel number (6)
Word 9	00000 (0000)	Number of write repetitions (write indefinitely)
Word 10	00003 (0003)	Time unit for write period (3=seconds)
Word 11	00007 (0007)	Number of time units for write period (every 7 seconds)
Word 12	00050 (0032)	Timeout for each write (500 ms)
Word 13	00008 (0008)	Local PLC - Memory type from which to write data (%R)
Word 14	00050 (0032)	Local PLC - Starting address from which to write data (%R50)
Word 15	00008 (0008)	Remote PLC - Memory type at which to store data (%R)
Word 16	00100 (0064)	Remote PLC - Starting address at which to store data (%R100)
Word 17	00008 (0008)	Remote PLC - Number of memory units (8 registers)
Word 18	00001 (0001)	Remote PLC - Network Address type (IP address)
Word 19	00004 (0004)	Remote PLC - Network Address length in words (4)
Word 20	00010 (000A)	Remote PLC - Register 1 of IP address (10)
Word 21	00000 (0000)	Remote PLC - Register 2 of IP address (0)
Word 22	00000 (0000)	Remote PLC - Register 3 of IP address (0)
Word 23	00001 (0001)	Remote PLC - Register 4 of IP address (1)
Word 24–27		Remote PLC - Program Name (needed for access to remote %P or %L) (zero-terminated and padded)
Word 28–31		Remote PLC - Program Block (needed for access to remote %L) (zero-terminated and padded)

* Word 4 (COMMREQ status word address) is the only zero-based address in the Command Block. Only this value requires subtracting 1 from the intended address.

(Word 7) Channel Command Number: Word 7 requests that a write channel be set up. If the command is processed successfully, it will result in attempting the specified number of transfers from the client to the server.

(Word 8) Channel Number: Word 8 specifies the channel to be used for the write. This value must be in the range of 1–32. If the channel number is out of range, a command error indication will be placed in the COMMREQ Status word. If the channel number is the same as a channel already in use, the channel will be re-tasked to perform this new command.

(Word 9) Number of Write Repetitions: Word 9 specifies the number of writes to be performed before automatically completing the communications request and closing the channel. If this value is set to 1, only a single write will be issued. If this value is set to 0, writes will be issued on the requested period until the channel is aborted.

(Word 10) Time Units for Write Period: Words 10–11 together define how often the write is to be performed (*write period*). Word 10 specifies the time unit such as seconds or minutes for the write period. Word 11 specifies the number of those units. The choices for the time units are:

Value	Meaning	
1	hundredths of seconds	(10 ms)
2	tenths of seconds	(100 ms)
3	seconds	
4	minutes	
5	hours	

(Word 11) Number of Time Units for Write Period: Word 11 specifies the number of time units for the write period. The write period is in effect even when the Channel command is setup to issue a single write.

Example Write Period Calculation: If Word 10 contains a value of 3 specifying seconds as the time unit and Word 11 contains a value of 20, then the write period is 20 seconds.

*A Channel command set up to issue a single write can have only one **pending** write transfer.* A write will normally be issued at the start of each write period. If the *pending* write transfer has not completed during the write period, the Channel Error bit and Detailed Channel Status words will be set to indicate a non-fatal period error. The pending transfer can still complete after the period error occurs. For Channel commands set up to issue multiple writes, the next write transfer will be issued only after the pending write transfer completes.

If the Number of Time Units is zero, a subsequent transfer will be issued as soon as the previous transfer completes. In this case, no period errors are reported by the Channel Error bit.

(Word 12) Timeout for Each Write: Word 12 specifies the time (in hundredths of a second) the Ethernet interface will wait for a write transfer to complete before setting the Channel Error bit and Detailed Channel Status bits to indicate a non-fatal timeout error. The transfer can still complete even after a timeout occurs. As a result, an application can choose what to do if one occurs. If the timeout value is specified as zero, no timeout errors will be reported.

For most applications a timeout is not needed because the write period acts as a timeout. (Word 12 should be zero for no timeout.) However, there are two special circumstances in which specifying a timeout is recommended:

- When the number of time units (Word 11) is zero, so that a subsequent transfer will be issued as soon as the previous transfer completes and no period errors are reported. In this case a timeout value can be specified so that timeout errors will be reported by the Channel Error bit.
- When the write period is very long (minutes or hours). In this case a shorter timeout value can be specified so the application doesn't have to wait for the write period to expire before taking action.

(Word 13) Local PLC - Memory Type: Words 13–14 specify the location in the local PLC where the Ethernet interface will get the data to be written to the remote PLC. Valid values for Word 13 are listed in the description of Establish Read Channel. The amount of data to be transferred is specified by the number of memory units of the data written to the remote PLC (Word 17).

(Word 14) Local PLC - Memory Starting Address: Word 14 determines the starting address in the local PLC from which the data is to be written. The value entered is the offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 13. This offset will be in bits, bytes, or words depending on the mode specified (for example, if Word 13=16 and Word 14=2, then the starting address will be %I9). Valid ranges of values depend on the PLC's memory ranges.

(Word 15) Remote PLC - Memory Type: Words 15–16 specify the memory type and starting address in the remote PLC where the data is to be written. Valid values for Word 15 are listed under Establish Read Channel. If %P memory is used, you must specify a Program name in Words 24–27. If %L memory is used, you must specify a Program name in Words 24–27 and a Program Block name in Words 28–31.

(Word 16) Remote PLC - Memory Starting Address: Word 16 determines the starting address in the remote PLC where the data is to be written. The value entered is the offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 15. This offset will be either in bits, bytes, or words depending on the mode specified (for example, if Word 15=16 and Word 16=9, then the starting address will be %I65). Valid ranges of values depend on the remote PLC's memory ranges.

(Word 17) Remote PLC - Number of Memory Units: Word 17 specifies the amount of data to be transferred. The value entered is the number of memory units to be transferred, where the size of a memory unit is either a bit, byte, or word as specified in Word 15. For example, if Word 15=16 and Word 17=4, then 4 bytes (32 bits) of %I memory will be transferred. The user is responsible for assuring that this area is large enough to contain the requested data without overwriting other application data. A maximum of 16384 bits, 2048 bytes, or 1024 words of data can be specified.

(Word 18) Remote PLC - Network Address Type: Word 18 specifies the format of the remote PLC address. Word 18 must contain the value 1, indicates a dotted-decimal IP address expressed using a separate register for each decimal digit.

(Word 19) Remote PLC - Network Address Length: Word 19 specifies the length in words of the remote PLC IP address. Word 19 must contain 4.

(Words 20–23) Remote PLC - IP Address: Words 20–23 specify the four integers, one integer per word, of the dotted-decimal IP address of the remote PLC to be accessed.

(Words 24–27) Remote PLC - Program Name: Words 24–27 specify the case-sensitive, zero-terminated and padded program name (also called task name, which can be found through the PROG Station Manager command on the server Ethernet interface) to be used with access to remote %P or %L memory. These words are required only for access to such memory and will be ignored if the Memory Type field is not %P or %L.

(Words 28–31) Remote PLC - Program Block Name: Words 28–31 specify the case-sensitive, zero-terminated and padded program block name (which can be found in the program block declaration in the server ladder program) to be used with access to remote %L memory. These words are required only for access to such memory and will be ignored if the Memory Type field is not %P or %L.

The Program Name (Words 24–27) and Program Block Name (Words 28–31) must have each pair of ASCII characters reversed within the PLC memory. For example, the name “MARY” (“M” = 4DH, “A” = 41H, “R” = 52H, “Y” = 59H) would have 414DH in the first word and 5952H in the second word.

Send Information Report (2010)

The Send Information Report COMMREQ requests that a particular block of memory within the PLC CPU reference tables be transferred periodically from an Ethernet interface to a host application SRTP server. The Command Block specifies the repetition period, the number of transfers to the server to perform, and the timeout allowed in waiting for each transfer to complete. The first send is performed immediately, regardless of the period specified.

Example Command Block

Establish a channel (Channel 7) to a remote Host application server at IP address 10.0.0.1. Return the COMMREQ Status word to %R10. Send local PLC registers %R50–%R57 to remote host. Repeat the send 10 times, once every 7 seconds, with a timeout of 500ms for each transfer.

*The term **local PLC** is used here to identify the **client PLC**—the PLC that initiates the communications request.*

*The term **SRTP Server** is used here to identify the **Host server.***

	Dec	(Hex)	
Word 1	00017	(0011)	Length of Send Information Report Data Block (17 words)
Word 2	00000	(0000)	Always 0 (no–wait mode request)
Word 3	00008	(0008)	Memory type of COMMREQ status word (%R)
Word 4	00009	(0009)	COMMREQ status word address minus 1 (%R10)*
Word 5	00000	(0000)	Reserved
Word 6	00000	(0000)	Reserved
Word 7	02010	(07DA)	Send Information Report Channel command number
Word 8	00007	(0007)	Channel number (7)
Word 9	00010	(000A)	Number of repetitions (send 10 times)
Word 10	00003	(0003)	Time unit for send period (3=seconds)
Word 11	00007	(0007)	Minimum interval between host accesses (every 7 seconds)
Word 12	00050	(0032)	Timeout on each individual transfer response (500 ms)
Word 13	00008	(0008)	Local PLC - Memory type from which to send data (%R)
Word 14	00050	(0032)	Local PLC - Starting address from which to send data (%R50)
Word 15	00008	(0008)	Local PLC - Number of memory units (8 registers)
Word 16	00000	(0000)	Reserved
Word 17	00000	(0000)	Reserved
Word 18	00001	(0001)	Remote Network Address type (IP Address)
Word 19	00004	(0004)	Remote Network Address length in words (4)
Word 20	00010	(000A)	Remote Host - Register 1 of IP address (10)
Word 21	00000	(0000)	Remote Host - Register 2 of IP address (0)
Word 22	00000	(0000)	Remote Host - Register 3 of IP address (0)
Word 23	00001	(0001)	Remote Host - Register 4 of IP address (1)

* Word 4 (COMMREQ status word address) is the only zero-based address in the Command Block.
Only this value requires subtracting 1 from the intended address.

(Word 7) Channel Command Number: Word 7 requests that a Send Information Report channel be set up. If the command is processed successfully, it will result in attempting the specified number of transfers from the client to the server.

(Word 8) Channel Number: Word 8 specifies the channel to be used for the send. This value must be in the range of 1–32. If the channel number is out of range, a command error indication is placed in the COMMREQ status word. If the channel number is the same as a channel already in use, the channel is re-tasked to perform this new command.

(Word 9) Number of Send Repetitions: Word 9 specifies the number of transfers to be performed before automatically completing the communications request and closing the channel. If this value is set to 1, only a single transfer will be issued. If this value is set to 0, transfers will be issued on the requested period until the channel is aborted.

(Word 10) Time Unit for Send Period: Words 10-11 together define how often the transfer is to be performed (*transfer period*). Word 10 specifies the time unit such as seconds or minutes for the send period. Word 11 specifies the number of those units. The choices for the time units are shown below.

Value	Meaning
1	hundredths of seconds (10 ms)
2	tenths of seconds (100 ms)
3	seconds
4	minutes
5	hours

(Word 11) Number of Time Units for Send Period: Word 11 specifies the number of time units for the send period. The send period is in effect even when the Channel command is set up to issue a single send. *A Channel command set up to issue a single send can have only one **pending** send transfer.*

Example Send Period Calculation: If Word 10 contains a value of 3 specifying seconds as the time unit and Word 11 contains a value of 20, the send period is 20 seconds.

A send is normally issued at the start of each send period. If the *pending* transfer has not completed during the send period, the Channel Error bit and Detailed Channel Status words are set to indicate a non-fatal period error. The pending transfer can still complete after the period error occurs. For Channel commands set up to issue multiple sends, the next transfer is issued only after the pending transfer completes.

If the Number of Time Units is zero, a subsequent transfer is issued as soon as the previous transfer completes. In this case, no period errors are reported by the Channel Error bit.

(Word 12) Timeout for Each Send: Word 12 specifies the time (in hundredths of a second) the Ethernet interface will wait for a send transfer to complete before setting the Channel Error bit and Detailed Channel Status bits to indicate a non-fatal timeout error. The transfer can still complete even after a timeout occurs. As a result, an application can choose what to do if one occurs. If the timeout value is specified as zero, no timeout errors will be reported.

For most applications a timeout is not needed because the send period acts as a timeout. (Word 12 should be zero for no timeout.) However, there are two circumstances where a timeout is recommended:

- If number of time units (Word 11) is zero, so that a subsequent transfer is issued as soon as the previous transfer completes and no period errors are reported. In this case a timeout value can be specified so that timeout errors will be reported by the Channel Error bit.

- If the send period is very long (minutes or hours). In this case a shorter timeout value can be specified so the application doesn't have to wait for the send period to expire before taking action.

(Word 13) Local PLC - Memory Type: Words 13–14 specify the location in the local PLC where the Ethernet interface will get the data to be written to the remote SRTP server. Valid values for Word 13 are listed for Establish Read Channel.

(Word 14) Local PLC - Memory Starting Address: Word 14 determines the starting address in the local PLC from which the data is to be sent. The value entered is the offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 13. This offset can be in bits, bytes, or words depending on the mode specified (for example, if Word 13=16 and Word 14=2, the starting address will be %I9). Valid ranges of values depend on the PLC's memory ranges.

(Word 15) Local PLC - Number of Memory Units: Word 15 specifies the amount of data to be transferred. The value entered is the number of memory units to be transferred, where the size of a memory unit is a bit, byte, or word as specified in Word 13. For example, if Word 13=16 and Word 15=4, then 4 bytes (32 bits) of %I memory will be transferred. A maximum of 16384 bits, 2048 bytes, or 1024 words of data can be specified.

(Word 16) Reserved: Word 16 is reserved and should contain the value zero.

(Word 17) Reserved: Word 17 is reserved and should contain the value zero.

(Word 18) Remote Host - Network Address Type: Word 18 specifies the format of the remote host's address. Word 18 must contain the value 1, which indicates a dotted-decimal IP address expressed using a separate register for each decimal digit.

(Word 19) Remote Host - Network Address Length: Word 19 specifies the length in words of the remote host's IP address. Word 19 must contain 4.

(Words 20–23) Remote Host - IP Address: Words 20–23 specify the four integers, one integer per word, of the dotted-decimal IP address of the remote host to be accessed.

Abort Channel (2001)

The Abort Channel command immediately disconnects an active channel from its remote PLC, and closes the channel. The Channel Transfer bit, the Channel Error bit, and the Detailed Channel Status words for the channel are set to zero.

Example Command Block

Abort Channel 5. Return the COMMREQ Status word to %R10.

	Dec (Hex)	
Word 1	00002 (0002)	Length of Channel command Data Block (2 words)
Word 2	00000 (0000)	Always 0 (no-wait mode request)
Word 3	00008 (0008)	Memory type of COMMREQ status word (%R)
Word 4	00009 (0009)	COMMREQ status word address minus 1 (%R10) (0-based)
Word 5	00000 (0000)	Reserved
Word 6	00000 (0000)	Reserved
Word 7	02001 (07D1)	Abort Channel command number
Word 8	00005 (0005)	Channel number 5

(Word 7) Channel Command Number: This command parameter requests that a channel be aborted. If the command is processed successfully, it terminates processing on the channel by the time success is indicated in the COMMREQ status word.

(Word 8) Channel Number: The channel number specifies the channel to be disconnected (1–32). As a convenient way to abort all channels, if the channel number parameter is –1 (FFFFH), all channels in use are aborted. It is *not* an error to abort all channels if there are none in use. Neither is it an error to abort an idle channel.

> **Note:** For the Abort Channel and Retrieve Detailed Channel Status commands, no actual data is transmitted on the network. Communication occurs between the client PLC CPU and the local Ethernet interface only. For these commands, the actual function is performed locally within the Ethernet interface and then the COMMREQ Status word is sent immediately to the CPU.

Retrieve Detailed Channel Status (2002)

The Retrieve Detailed Channel Status command requests that the *current* Detailed Channel Status words are returned for a channel. The Detailed Channel Status words contain an active/inactive channel indicator and the last channel error codes seen. These two words of detailed status supplement the information available in the COMMREQ Status word and the Channel Status bits. The command has no effect on the value of the Channel Status bits.

The Detailed Channel Status words are updated every time the status of the channel changes. If the channel is operating with a fast repetition period, the status words may change faster than the ladder executes the COMMREQ to retrieve them. If that happens, some status values could be missed by the application program.

Example Command Block

Retrieve detailed channel status for Channel 5. Store the Detailed Channel Status words to Registers %R100–%R101. Return the COMMREQ status word to %R10.

*The term **local PLC** is used here to identify the **client PLC**—the PLC that initiates the communications request.*

	Dec	(Hex)	
Word 1	00004	(0004)	Length of Channel command Data Block (4 words)
Word 2	00000	(0000)	Always 0 (no-wait mode request)
Word 3	00008	(0008)	Memory Type of COMMREQ status word (%R)
Word 4	00009	(0009)	COMMREQ status word address minus 1 (%R10)*
Word 5	00000	(0000)	Reserved
Word 6	00000	(0000)	Reserved
Word 7	02002	(07D2)	Retrieve Detailed Channel Status Command number
Word 8	00005	(0005)	Channel number 5
Word 9	00008	(0008)	Local PLC - Memory type to store Detailed Chan. Stat. (%R)
Word 10	00100	(0064)	Local PLC - Starting address (%R100)

* Word 4 (COMMREQ status word address) is the only zero-based address in the Command Block. Only this value requires subtracting 1 from the intended address.

(Word 7) Channel Command Number: The command parameter in Word 7 requests that Detailed Channel Status words be returned. The Detailed Channel Status words are written to the location specified in Words 9 and 10. The COMMREQ status word indicates successful completion of the command. If the specified channel is not currently in use, the latest status is returned.

(Word 8) Channel Number: The channel number in Word 8 specifies the channel (1 – 32) whose status is to be read.

(Word 9) Local PLC - Memory Type: Words 9 and 10 specify the starting point in the client CPU memory where the Detailed Channel Status words are to be written. The length of the transfer is always 2 words.

(Word 10) Local PLC - Memory Starting Address: Word 10 determines the starting address to store the Detailed Channel Status data. The value entered is the offset (1-based) from the beginning of PLC memory for the memory type and mode specified in Word 9. This offset is in bits, bytes, or words depending on the mode specified (for example, if Word 9=16 and Word 10=2, then the starting address will be %I9). Valid ranges of values depend on the PLC's memory ranges. Make sure this area can contain the 2 words of data without overwriting other application data.

> **Note**: For the Abort Channel and Retrieve Detailed Channel Status commands, no actual data is transmitted on the network. Communication occurs between the client PLC CPU and the local Ethernet interface only. For these commands, known as "local" commands, the actual function is performed locally within the Ethernet interface and then the COMMREQ Status word is sent immediately to the CPU.

Monitoring the Detailed Channel Status Words

The Detailed Channel Status words (DCS words) are returned from the Ethernet interface to the CPU in response to a Retrieve Detailed Channel Status command from the application program. The first two Detailed Channel Status bytes report status and errors in the same format as the COMMREQ Status word. See the list of error codes in chapter 9.

The second word of the DCS words indicates when the channel is active.

If a channel error is indicated (by the Channel Error bit) after the channel is established, the first word of the DCS words contains an error code indicating the cause of the error. The second word of the DCS words indicates whether the channel is active or idle.

The Detailed Channel Status words are updated in the Ethernet interface every time the status of the channel changes. If the channel is operating with a fast repetition period, the status words may change faster than the ladder executes the COMMREQ to retrieve them. Therefore, some status values may be missed by the program logic.

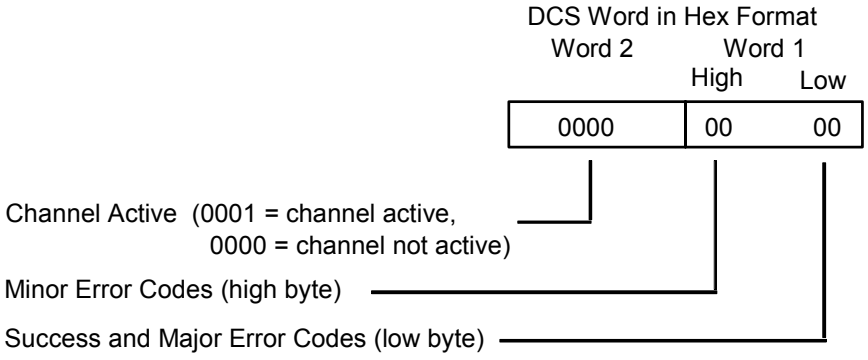
The DCS words location is specified in the Retrieve Detailed Channel Status Command. The contents of these status words are defined below.

The initial value of the Detailed Channel Status words is all zeros. DCS words are reset to zero when:

- The Ethernet interface is powered up or restarted
- The CPU transitions from STOP to RUN
- A channel abort COMMREQ aborts the channel

Format of the Detailed Channel Status Words (DCS Words)

Display the DCS status words in hexadecimal form to differentiate the high and low bytes.



Programming for Channel Commands

The COMMREQ function for a Channel command must be initiated by a one-shot. That will prevent the COMMREQ from being executed each CPU scan, which would overrun the capability of the Ethernet interface and possibly require a manual restart. Checking certain status bits before initiating a COMMREQ function is also important. In particular, the LAN interface OK bit should be used as an interlock to prevent execution of the COMMREQ when the Ethernet interface is not operational. After initiating a COMMREQ on a channel, no further COMMREQs should be issued to that channel until a non-zero COMMREQ status word has been returned to the program from the Ethernet interface.

Every ladder program should do the following before initiating a COMMREQ function.

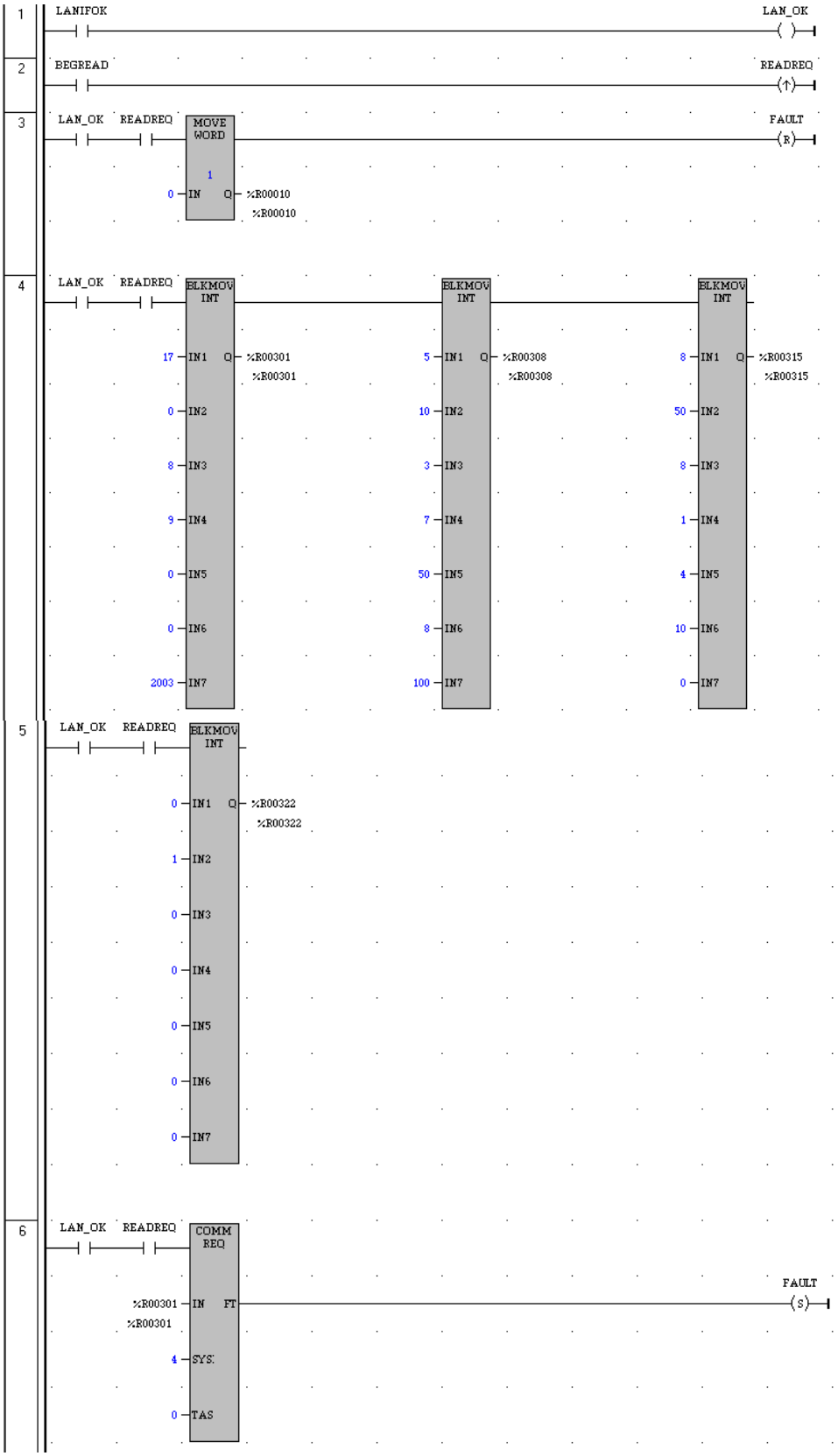
1. Initiate the COMMREQ function with a one-shot. This prevents sending the same COMMREQ Command Block more than once.
2. Include at least the LAN interface OK bit in the LAN interface Status Word as an interlock contact for the COMMREQ function.
3. Zero the word location you specify for the COMMREQ status word and FT Outputs of the COMMREQ function block before the COMMREQ function is initiated.
4. Move the command code and parameters for the Channel command into the memory location specified in the IN input of the COMMREQ Function Block before the COMMREQ function is initiated.

An example ladder program segment on the next page illustrates these points.

COMMREQ Example

In the example logic that follows, the input values for the Block Move Functions are taken from the Establish Read Channel (2003) command Example 1 in this chapter.

Nicknames are used in this example to make the ladder program easier to follow. LANIFOK is bit 16 of the LAN Interface Status bits. All other nicknames can be assigned as needed.


1
LANIFOK
LAN_OK
2
BEGREAD
READREQ
3
LAN_OK
READREQ
MOVE WORD
1
0
IN
Q
%R00010
%R00010
FAULT
4
LAN_OK
READREQ
BLKMOV INT
17
IN1
Q
%R00301
%R00301
0
IN2
8
IN3
9
IN4
0
IN5
0
IN6
2003
IN7
BLKMOV INT
5
IN1
Q
%R00308
%R00308
10
IN2
3
IN3
7
IN4
50
IN5
8
IN6
100
IN7
BLKMOV INT
8
IN1
Q
%R00315
%R00315
50
IN2
8
IN3
1
IN4
4
IN5
10
IN6
0
IN7
5
LAN_OK
READREQ
BLKMOV INT
0
IN1
Q
%R00322
%R00322
1
IN2
0
IN3
0
IN4
0
IN5
0
IN6
0
IN7
6
LAN_OK
READREQ
COMM REQ
%R00301
%R00301
IN
FT
4
SYS
0
TAS
FAULT
(S)

Rung # 1: Input LANIFOK (bit 16 of the LAN interface Status bits) monitors the health of the Ethernet interface. If it is OK to send a COMMREQ, the LAN_OK coil is ON. LAN_OK is used as an interlock for Rungs 3–6.

Rung # 2: Input BEGREAD triggers READREQ, which enables execution of the MOVE and COMMREQ functions. READREQ is a one-shot (Positive Transition) coil, activating once when BEGREAD transitions from OFF to ON.

Rung # 3: The MOVE WORD function moves a zero to the COMMREQ status word referenced in the Command Block (see rung #4). This clears the COMMREQ status word. This rung also resets the FT output coil of the COMMREQ Function Block in rung #6.

It is vital that the COMMREQ status word be cleared and the COMMREQ fault output coil be cleared each time before initiating a COMMREQ function.

Rungs # 4–5: The BLKMV INT functions set up the COMMREQ Command Block contents. When these rungs are activated, the constant operands are moved into the memory beginning at the address indicated in the instruction. The constant operands in this example are defined in the Establish Read Channel Example in this chapter.

Rung # 6: The COMMREQ Function Block.

- The IN field points to the starting location of the Command Block parameters (%R00301 in this example).
- The SYSID field of the COMMREQ function block defines the rack and slot of the Ethernet interface to receive the command data. This is a hexadecimal word value that gives the rack (high byte) and slot (low byte) location of the Ethernet interface module. In the example ladder diagram shown, the first three number places (from left to right) are zeros and are not displayed; only the last number, 4, appears. This indicates rack 0, slot 4. For CPU374 , you must use rack 0, slot 1 (0001H or simply 1.)
- The TASK field of the COMMREQ function block indicates which mailbox task ID to use for the specified rack and slot. For CPU374 , this value should always be 21 decimal (0015H).
- The FT output (energizes the FAULT coil in this example) is turned ON (set to 1) if there were problems preventing the delivery of the Command Block to the Ethernet interface. In this case, the other status indicators are not updated for this COMMREQ.

Sequencing Communications Requests

If the Ethernet interface receives Command Blocks from the PLC CPU faster than they can be processed, the Ethernet interface will log an exception event 08, Entry 2=0024H and will log the PLC Fault Table entry:

"Backplane Communications with PLC Fault; Lost Request"

Only one COMMREQ function per channel can be pending at one time. A COMMREQ function is pending from the time it is initiated in the ladder program until its COMMREQ status word has been updated to a non-zero value by the Ethernet interface.

If the PLC CPU attempts to send COMMREQs to the Ethernet interface faster than the Ethernet interface can receive them, the FT output of the COMMREQ function block is set and the CPU generates the following entry in the PLC Fault Table:

"Mailbox queue full – Comm_req aborted"

The PLC logic program should retry the COMMREQ after a short delay.

Managing Channels and TCP Connections

In Certain Conditions TCP Connections Can Be Totally Consumed

When you issue a COMMREQ to establish a read or write channel, a TCP connection is created, the transfer(s) are made, then upon completion of all the transfers, the TCP connection is terminated. It takes time to create and to terminate these connections. If an application is constructed so that it rapidly and repeatedly establishes a channel with only one repetition (one transfer), the available TCP connections for the Ethernet interface may be totally consumed. A "snapshot" of the state of the TCP connections would show some of them being created, some being terminated, and some active, but none available.

If the logic for issuing COMMREQs is constructed so it does the following, all available TCP connections can quickly be used up:

- The number of repetitions (Word 9 in an Establish Read or Write Channel COMMREQ) is set to 1, *and*
- A new COMMREQ is issued repeatedly and immediately upon completion of the prior one.

Use "Channel Re-Tasking" To Avoid Using Up TCP Connections

TCP connections can be used up if each successive COMMREQ is directed to the same target device (same IP address). In this case, it is better to establish a channel with the target device once, leave it active, then re-task the channel, even if data transfers take place infrequently. This method will use only one TCP connection.

An additional advantage of re-tasking is that the time and network traffic required to create a channel and its associated TCP connection are not incurred each time a data transfer is required.

The disadvantages to re-tasking are:

- While the TCP connection is open, it is unavailable to the rest of your application, and
- The active TCP connection uses up network bandwidth because the active TCP connection generates a small amount of ongoing periodic network traffic.

How To Re-Task a Channel

1. For Establish Read/Write Channel Commands, set the number of repetitions (COMMREQ Word 9) to 2 and set the read/write period (COMMREQ Words 10 and 11) to be longer than the expected time between transfers. For example, if you expect to transfer data about once per minute, set the read/write period to about two minutes. This will cause a TCP connection to be created and held open for two minutes.
2. Set up the ladder program to:
   A. Issue the first COMMREQ and wait for the first transfer to complete, which will be indicated when the COMMREQ Status (CRS) word is changed to 1.
   B. Then before the read/write period expires (at which time the second and final transfer is sent and the TCP connection is dropped), issue the next COMMREQ with the same parameters as specified in step 1. This will "re-task" the channel to use the existing TCP connection instead of opening a new one, and will send another data transfer restarting the timer for the read/write period. Repeat step 2B for each successive data transfer desired.

Client Channels TCP Resource Management

There is a period of time that the OS Network stack hangs on to the TCP resources associated with a connection after it is closed. It applies to the initiator of the close, which is almost always the client side. This time is referred to as the "TCP Linger Period". Once the TCP Linger Period expires (60 seconds in the current OS implementation), the TCP resources are released. Application developers using client channels need to be aware of this behavior when designing their logic. There are a finite number of TCP resources allocated to client channels, and if channel connections are brought up and down so fast that these resources are depleted, then the application may have to wait until a TCP resource frees up in order to establish another client channel (a COMMREQ Status of 0xA890 is returned if no TCP resources are currently available; application should wait and retry again).

SRTP Client Channels provides features that help the user preserve TCP connections. These include a period time where one can establish an SRTP Channel and specify the channel to run at a given interval, or run as fast a possible. One can also specify a number of iterations, or run forever. Additionally, SRTP Channels allows channel re-tasking of an active channel to the same remote device, where the parameters of an active channel, such as changing the channel command type (Read/Write), number of repetitions, time periods, local memory address, remote memory address, etc. can be changed. SRTP Channels also allows channel re-tasking of an active channel to a different remote device (changing the remote device's IP address, etc.). However, re-tasking to a different remote device will neither conserve TCP connections, nor save on the time it takes to create a channel.

SRTP Application Timeouts

The application timeouts within SRTP Channels also include the time needed to establish and maintain the underlying network and SRTP connection. Examples are establishing the TCP connection for a new channel, establishing communication with the remote device, and TCP retransmissions during Channel operations. If the time needed for TCP connection establishment or maintenance exceeds the user-specified channel application timeout values, an application timeout will occur. Channel application timeouts are temporary errors; the channel continues to run when the expected response is received.

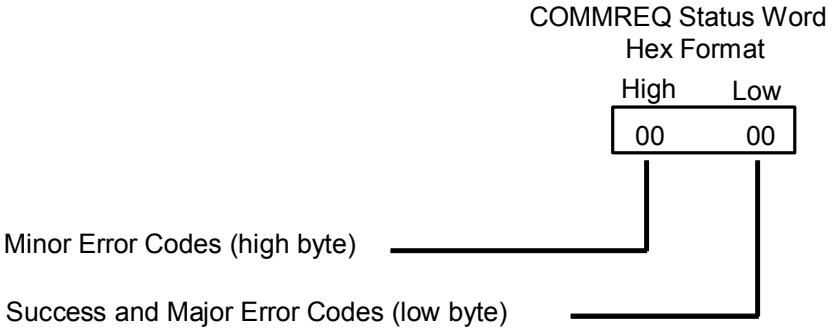
If the application is seeing timeouts during channel startup, there are a few different options:

1. Increase timeout value to account for Channel connection overhead
2. Ignore the timeout error on the first transfer
3. Use a two-step setup approach where the first COMMREQ has a timeout large enough to account for the connection overhead and then Re-Task the channel to the normal operating timeouts.

Monitoring Channel Status

The COMMREQ Status word is returned from the Ethernet interface to the PLC CPU immediately if the Command Block contains a syntax error or if the command is local. For remote commands with no syntax error, it is returned either after the channel is established successfully and the first transfer has completed or if there is an error establishing the channel. The location of the COMMREQ status word is defined in the Command Block for the COMMREQ function.

Format of the COMMREQ Status Word



It is critical to monitor the COMMREQ status word for each COMMREQ function. Zero the associated COMMREQ status word before executing the COMMREQ function. When the COMMREQ status word becomes non-zero, the Ethernet interface has updated it.

If after executing a COMMREQ function, the COMMREQ status word is zero (0) and the FT Output is OFF, the Command Block has been sent to the Ethernet interface, but no status has been returned. If this condition persists, check the PLC Fault Table for information.

If the COMMREQ status word is updated to 1, the Command Block was processed successfully by the Ethernet interface.

If the COMMREQ status word is updated to a value other than 1, an error has occurred in processing the Command Block. The cause may be:

- Errors in the Command Block (the Channel command code or parameters), or
- For an establish command (Establish Read Channel, Establish Write Channel, or Send Information Report), the command parameters were valid but there was an error in establishing a channel.

Chapter 9 lists the Major and Minor error codes that may be returned in the COMMREQ status words. Do not use data received from a server until the COMMREQ status word for that channel is 1 or the Data Transfer bit goes to 1.

New Features of SRTP Channels

This section lists differences between earlier implementations of SRTP Channels in Series 90 family PLCs, and the new implementation that is used for both Series 90-30 CPU374 *PLUS* and PACSystems Ethernet interfaces.

1. The TCP Connect Timeout for an SRTP Channel was 90 seconds. For the CPU374 *PLUS* and for PACSystems, a new SRTP AUP parameter, "SRTP Channel TCP Connect Timeout", specifies the amount of time to wait for a TCP connection to be established: hconn_tout. The default value is its maximum: 75 seconds. The minimum value is 10 milliseconds.
2. For CPU374 *PLUS* and PACSystems, there is now a TCP Linger Period. The TCP Linger Period is the period of time the OS Network stack hangs onto the TCP resources associated with a connection after it is closed. The TCP resources from a channel that was stopped become available again after the 60 second TCP linger period expires. The earlier Series 90 Channels implementation had no linger period.
3. A Run-to-Stop transition now causes an Abrupt Shutdown, avoiding the TCP Linger period and reducing the chance of exhausting TCP resources when quickly transitioning between Run->Stop and Stop->Run. The earlier Series 90 SRTP Channel implementation performed a normal stopping of the channel on a Run-to-Stop transition.
4. If an Abort/Abort All Channel COMMREQ is issued, followed by an Establish Read/Write/Send Info Report Channel COMMREQ before the COMMREQ Status Word for the Abort/Abort All has been updated, the Establish Read/Write/Send Information Report COMMREQ is now discarded and its COMMREQ Status Word is set to a failure value (A990). That indicates it was discarded because the application logic issued the command while an Abort was in progress.

   In earlier Series 90 SRTP Channels implementations, the Establish Read/Write/Send Information Report was dropped and the COMMREQ Status Word was not updated (it remained zero).
5. This implementation uses new COMMREQ Status Codes. See chapter 9 for details.
6. This implementation supports Re-tasking to a different remote device (different IP Address).
7. The CPU374 *PLUS* enhanced Ethernet interface simultaneously supports up to 16 SRTP Client (Channel) connections and up to 20 SRTP Server connections. (Prior to version 12.0, CPU374 limited the total number of SRTP Channels and SRTP Server connections to 20 connections.)

Chapter 7 Network Administration

This chapter discusses how devices are identified on the network and how data is routed among devices. The main topics covered are:

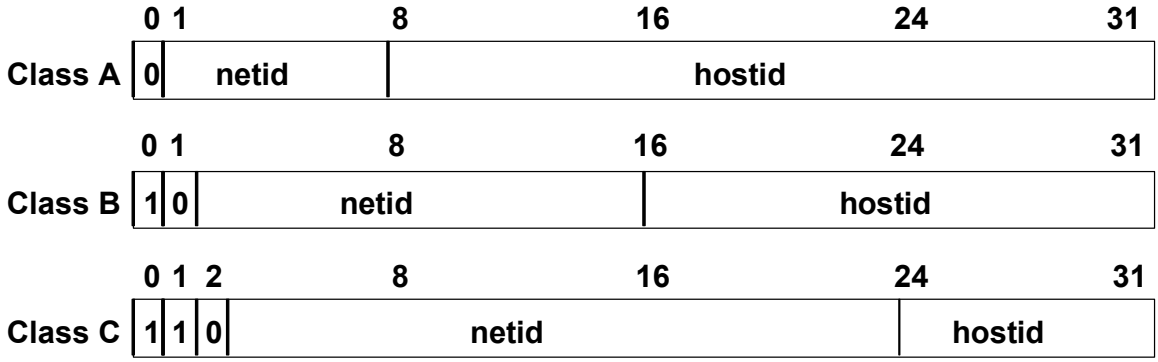
- IP Addressing
- Gateways
- Subnets

IP Addressing

Each TCP/IP node on a network must have a unique IP address. The TCP/IP Ethernet Interface is such a node, as is a PC running TCP/IP. There may be other nodes on the network that are not involved with communications to the PLCs, but no matter what their function, each TCP/IP node must have its own IP address. It is the IP address that identifies each node on the IP network (or system of connected networks). The term “host” is often used to identify a node on a network.

IP Address Format for Network Classes A, B, C

The *IP address* is 32 bits long and has a *netid* part and a *hostid* part. Each network is a Class A, Class B or Class C network. The class of a network determines how an IP address is formatted and is based on the number of bits in the netid part of the IP address.



In general, the netid part is assigned by the Internet authorities and the hostid part is assigned by your local network administrator. The class of network determines the number of hosts that can be supported. A Class A network can support 2^{24}-2 (16,777,214) hosts, Class B, 2^{16}-2 (65,534) hosts, and Class C, 2^{8}-2 (254) hosts. The minus 2 refers to host numbers reserved for the network itself and the local broadcast.

Each node on the same physical network must have an IP address of the same class and must have the same netid. Each node on the same physical network must have a different hostid thus giving it a unique IP address.

IP addresses are written in “dotted-decimal” format as four decimal integers (0-255) separated by periods where each integer gives the value of one byte of the IP address. For example, the 32-bit IP address:

00001010 00000000 00000000 00000001

is written as

10.0.0.1

One can determine the class of an IP address by examining the first integer in its dotted-decimal IP address and comparing with the range of values in the following table.

Range of first integer	*Class*
0 – 126	A
127	Loopback
128 - 191	B
192 - 223	C
224-239	D (Reserved for Multicast Use)
240 - 255	E (Reserved for Experimental Use)

IP Addresses Reserved for Private Networks

RFC 1918 reserves IP addresses in the following ranges to be used for private networks.

10.0.0.0 – 10.255.255.255 (Class A)
172.16.0.0 – 172.31.255.255 (Class B)
192.168.0.0 – 192.168.255.255 (Class C)

Multicast IP Addresses

Multicast IP Addresses are used in multicasting, a technique that allows delivery of a single packet of data to multiple nodes on the network. Any node that joins a Multicast group will respond to the Multicast IP address assigned to that group. Subsequently, any data sent to that Multicast IP address may be received by all nodes which are members of that Multicast group. Multicast (Class D) IP addresses (224.0.0.0 through 239.255.255.255) are reserved by the Internet authorities for multicasting.

Multicasting is a feature of Ethernet Global Data. For more information on the use of multicasting in Ethernet Global Data, see chapter 4.

Loopback IP Addresses

Class A IP Addresses in the 127.xxx.xxx.xxx range are reserved for loopback addressing. A network packet using a loopback destination address is not actually transmitted on the network, but instead is processed by the same device as if it were received from the network.

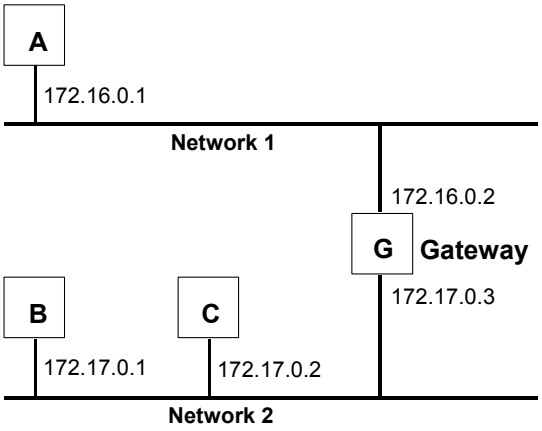
The CPU 374 enhanced Ethernet interface recognizes only the IP address 127.0.0.1 as a loopback address. All other addresses in the range 127.0.0.2 – 127.255.255.255 are ignored and do not provide loopback operation.

Gateways

Gateways (also known as routers) connect individual physical networks into a system of networks. When a node needs to communicate with a node on another physical network, a gateway transfers the data between the two networks.

Networks Connected by a Gateway

The following example shows Gateway G connecting Network 1 with Network 2.



When host B with IP address 172.17.0.1 communicates with host C, it knows from C's IP address that C is on the same network. In an Ethernet environment, B can then resolve C's IP address to a MAC address (via ARP) and communicate with C directly.

When host B communicates with host A, it knows from A's IP address that A is on another network (the *netids* are different). In order to send data to A, B must have the IP address of the gateway connecting the two networks. In this example, the gateway's IP address on Network 2 is 172.17.0.3. This address would be configured in the Ethernet Interface's module configuration for PLC B as its default gateway address.

Note that the gateway has two IP addresses (172.16.0.2 and 172.17.0.3). The first must be used by hosts on Network 1 and the second must be used by hosts on Network 2. To be usable, a host's gateway must be addressed using an IP address with a *netid* matching its own.

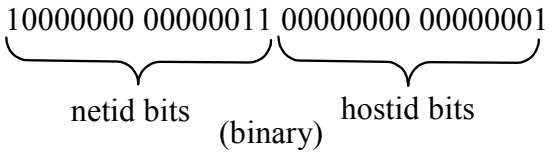
Subnets

Subnets allow a site's network administrators to divide a large network into several smaller networks while still presenting the overall network as one single entity to the outside world. Each of the site's interior gateways need only maintain the subnet numbers of other interior gateways instead of every single host on the entire network.

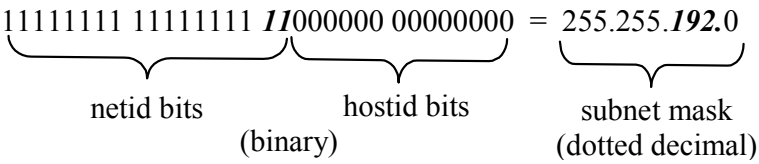
Subnet Addressing and Subnet Masks

Subnet addressing is an extension of the IP address scheme that allows a site to use a single netid for multiple physical networks. Routing outside the site continues as usual by dividing the IP address into a netid and a hostid via the class.

The standard format for the netid bits and hostid bits for an IP address in a Class B network is shown below.



Inside a site the *subnet mask* is used to re-divide the IP address into a custom netid portion and hostid portion. Consider adding another physical network to Network 2 (a Class B network) in the previous example. The result is shown in the figure below. Selecting the subnet mask shown below would add two additional *netid* bits allowing for four physical networks addressed as 0, 64, 128, and 192. The added subnet bits are normally taken from the *hostid bits* adjacent to the *netid* and the subnet mask identifies these bits.

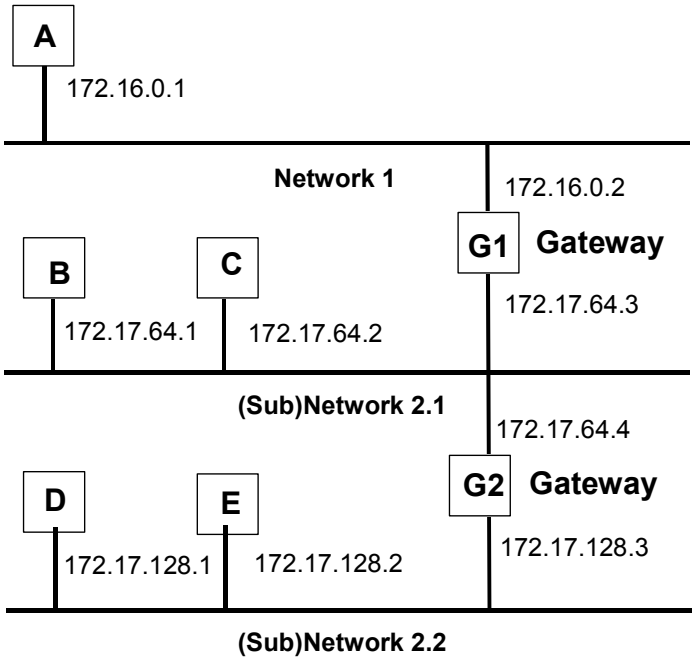


The bits in the subnet mask correspond one to one with the Internet address. The bits in the mask that are 1 treat the corresponding bits in the IP address as part of the *netid* bits. The bits in the mask that are 0 treat the corresponding bits as part of the *hostid* bits.

In effect, two bits of the Class B *hostid* have been used to extend the *netid,* creating an *extended netid*, or *subnetid*. Each unique combination of bits in the part of the *hostid* where subnet mask bits are 1 specifies a different physical network.

Example: Network Divided into Two Subnets

The new network configuration dividing Network 2 into Subnets 2.1 and 2.2 is shown below.



Here, a second network with Hosts D and E has been added. Gateway G2 connects Subnet 2.1 with Subnet 2.2. Hosts D and E will use Gateway G2 to communicate with hosts not on Network 2.2.

Hosts B and C will use Gateways G1 and G2 to communicate with hosts not on Network 2.1. When B is communicating with D, G2 (the configured Gateway for B) will route the data from B to D through Gateway G2.

Host A will use Gateway G1 to communicate with hosts not on Network 1.

Chapter 8 PLC Monitoring Via the Web

The Series 90-30 CPU374 *PLUS* enhanced Ethernet interface provides PLC data monitoring using a standard Web browser.

You can use the Web server to monitor the following PLC data:

- **PLC reference tables.** This data is a snapshot of the PLC Reference Tables when the data is displayed in the browser and is not updated until you request another display. All reference tables are supported.
- **PLC and IO Fault Tables.**

The web server cannot be used to modify PLC data (acknowledge alarms, set/force values in tables).

The maximum number of web server connections that can be configured for the CPU374 *PLUS* Ethernet interface is 16. If the system includes FTP server connections, fewer web server connections are available, as explained later in this chapter.

System Requirements

Web monitoring requires version 4.0 or later of Netscape Navigator or Internet Explorer. The browser must be capable of running the Java Virtual Machine (JVM) version 1.3 plug-in. The supported host operating systems are Windows NT 4.0 SP5 or SP6, Windows 95B, Windows 98 (First Edition Service Pack 1, Second Edition), and Windows 2000 Professional SP1, Windows Millennium Edition, Windows XP and Windows CE 3.0. To view the entire Reference Table page, the screen resolution must be 1024 x 768 or higher. Local web firewall blocking issues will be avoided by using HTTP protocol on port 80 to transfer standard HTML files including JavaScript and Java applets from the server to the browser and HTTP Post command to transfer form information from the browser to the server.

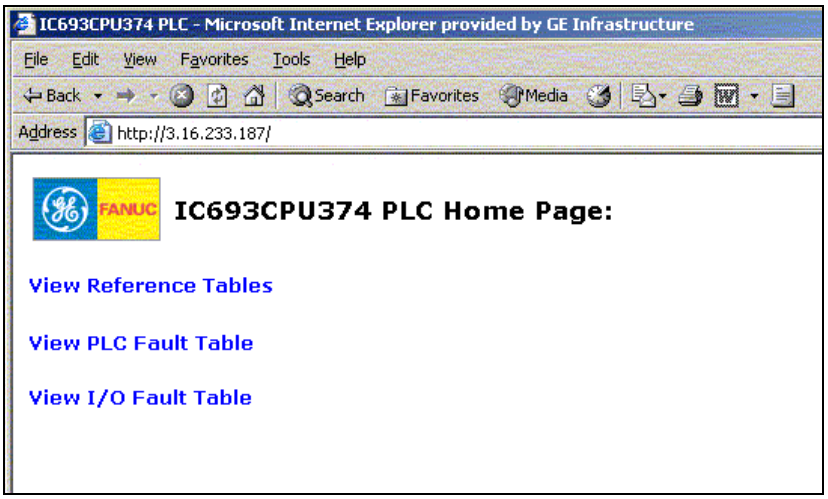
Standard Web Pages

The CPU Ethernet Interface is shipped with a set of standard PLC web pages already installed. These standard web pages include a PLC home page, a Reference Table display page, a PLC Fault Table display page, and an IO Fault Table display page.

When necessary, new or revised web page files may be transferred into the Ethernet interface via the standard FTP protocol, as described in this section.

CPU374 PLUS Home Page

The home page is displayed after entering the PLC CPU's URL or IP address at your web browser. From the PLC home page, you may navigate to the other PLC web pages.

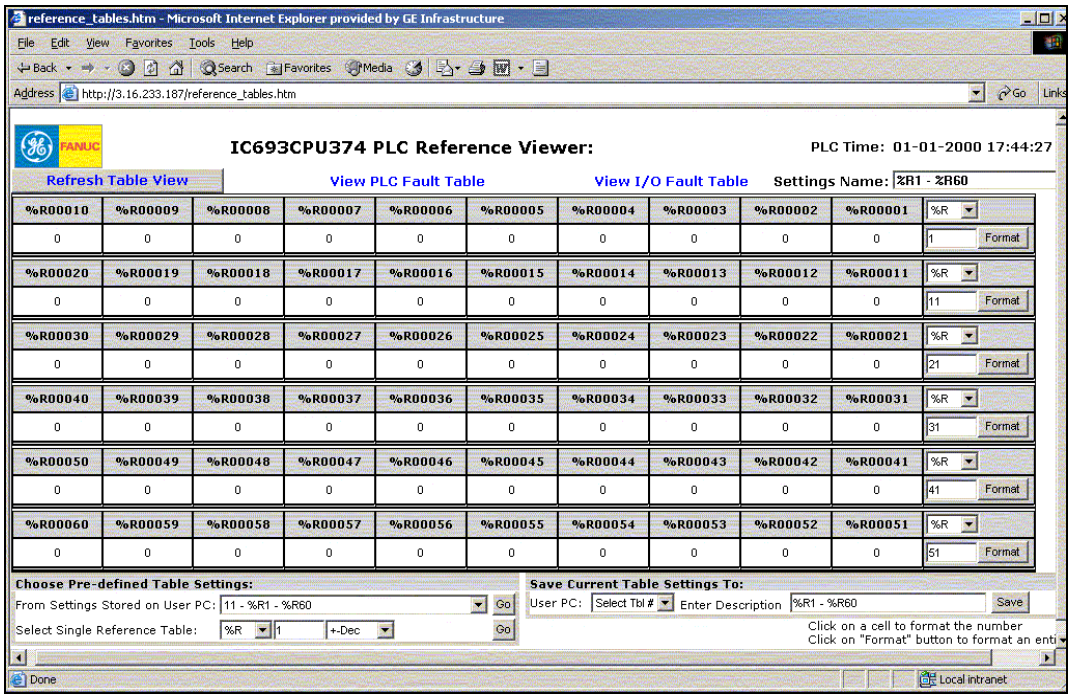

IC693CPU374 PLC - Microsoft Internet Explorer provided by GE Infrastructure
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://3.16.233.187/
FANUC
IC693CPU374 PLC Home Page:
View Reference Tables
View PLC Fault Table
View I/O Fault Table

Factory Default Web Page

If the PLC home page file (index.htm) is not present in the Ethernet interface file system, the web server instead displays a factory default web page. The default web page is displayed in English, French, German and Spanish if the browser is configured to use Western European encoding.

Reference Tables Viewer Page

The Reference Tables Viewer page shows the current states of a range of data references. This data is a snapshot of the PLC Reference Tables when the data was initially requested. It is NOT updated until you refresh the display. All the PLC Reference Tables are available.

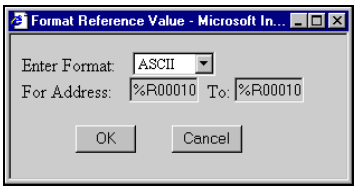

reference_tables.htm - Microsoft Internet Explorer provided by GE Infrastructure
File Edit View Favorites Tools Help
Address http://3.16.233.187/reference_tables.htm
IC693CPU374 PLC Reference Viewer:
PLC Time: 01-01-2000 17:44:27
Refresh Table View
View PLC Fault Table
View I/O Fault Table
Settings Name: %R1 - %R60
Choose Pre-defined Table Settings:
From Settings Stored on User PC:
Select Single Reference Table:
Save Current Table Settings To:
User PC:
Enter Description
Save
Click on a cell to format the number
Click on "Format" button to format an enti
Done
Local intranet

Selecting Reference Table Data

Initially, the previously-viewed reference table is shown. To change the display, you can:

- Select Reference Table Data Row-by-Row. The right column of each row contains the configuration options for that row. For each row, select the reference table, starting address, and data format. You can select the %R, %AI, %AQ, %I, %Q, %M, %T, %G, %S, %SA, %SB, or %SC reference table.
- Format a row by clicking the Format button for the entire row. Use the drop-down box to select the data format for the selected reference address or row. With Internet Explorer, pressing the “OK” button changes the format immediately. With Netscape, the format changes after you refresh the screen.

- Select the data format by clicking on a reference table address cell above the reference value and choosing the display format type. For example:



Binary: uses 1s and 0s to represent the bits in a byte or word of data. If a discrete bit is overridden for the %I, %Q, %M or %G tables, the bit is underlined.

+-Dec: signed decimal for one word of data. Valid range is –32768 to +32767.

Dec: unsigned decimal for one word of data. Valid range is 0 to 65535.

Hex: a four digit hexadecimal value for one word of data. The value has 16# as a prefix (for example 16#4241).Valid range is 16#0000 to 16#FFFF.

ASCII: ASCII representation of two 8-bit values. For example, a hex value of 16#4142 appears as “A B”. ASCII display requires Internet Explorer 4.0 or Netscape 4.7 or later.

+-DblDecimal: signed decimal for a double word (32 bits). Valid range is -2,147,483,648 to +2,147,483,647. This format is only available for word type memory (%R, %AI, % AQ, %P, %L, and %W).

DblDecimal: unsigned decimal for a double word (32 bits). Valid range is 0 to 4,294,967,295. This format is only available for word type memory (%R, %AI, %AQ, %P, %L, and %W).

Real: 7 decimal digits plus a decimal point and exponent if necessary (for example 123.4567, 1.234567e+038). This format uses 2 words or 32 bits. This format is only available for word type memory (%R, %AI, %AQ, %P, %L, and %W). The range is +-1.401298e-045 to +-3.402823e+038.

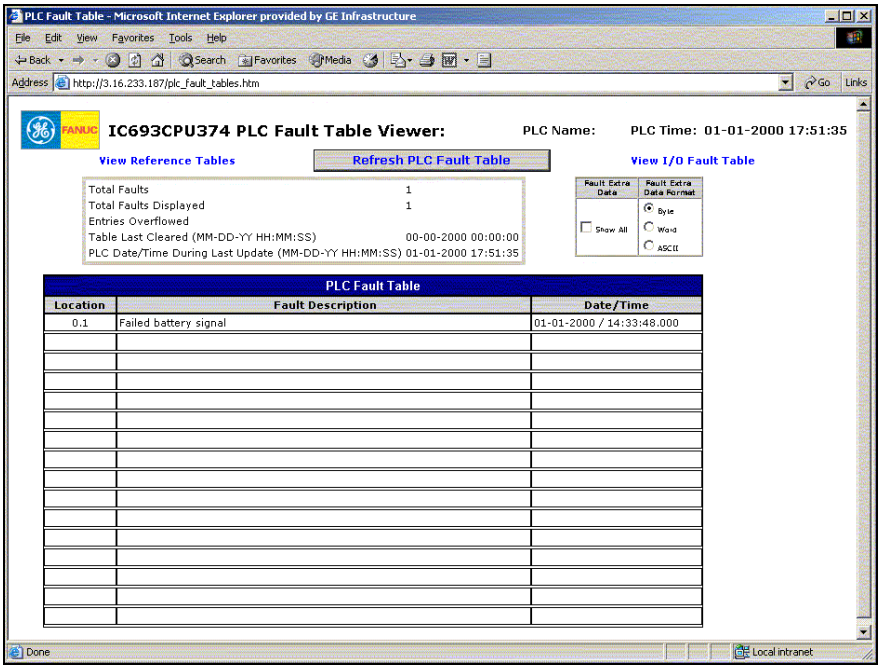
Blank: The associated cell or row will have no value or reference address header.

Saving Reference Table Settings

You can save up to 10 previously formatted reference table views on the computer being used to view the data. To save the current reference table settings, go to the section at the bottom of the page labeled ‘Save Current Table Settings To:’. From the drop-down box, select a number to assign to these settings. Optionally, enter a description of the table settings by typing into the text box labeled ‘Enter Description’. Click on the ‘Save’ button to save the reference table settings to the computer.

PLC Fault Table Viewer Page

The PLC Fault Table Viewer displays the contents of the PLC fault table.



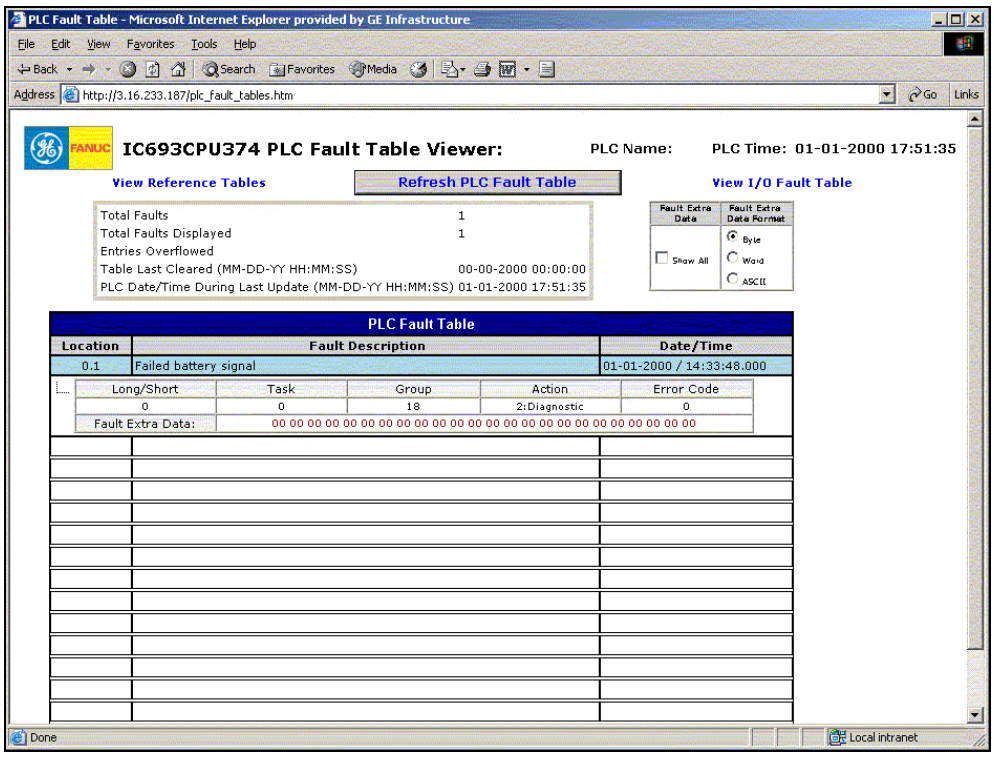
The PLC name is shown at the top of the page, together with the PLC timestamp showing when the page was accessed or refreshed.

The PLC fault table provides up to 16 entries arranged from newest to oldest. If there are fewer than 16 entries, the remaining rows are blank. If there are more than 16 faults, the table displays the most recent faults in the first 8 rows and the oldest faults in the last 8 rows.

To change the format of the fault extra data, select the appropriate checkbox at the top of the page.

To refresh the fault data, click the ‘Refresh PLC Fault Table’ button.

When using Internet Explorer, the fault extra data can be viewed by using the mouse to highlight a particular fault and then clicking on the fault. This is shown below:



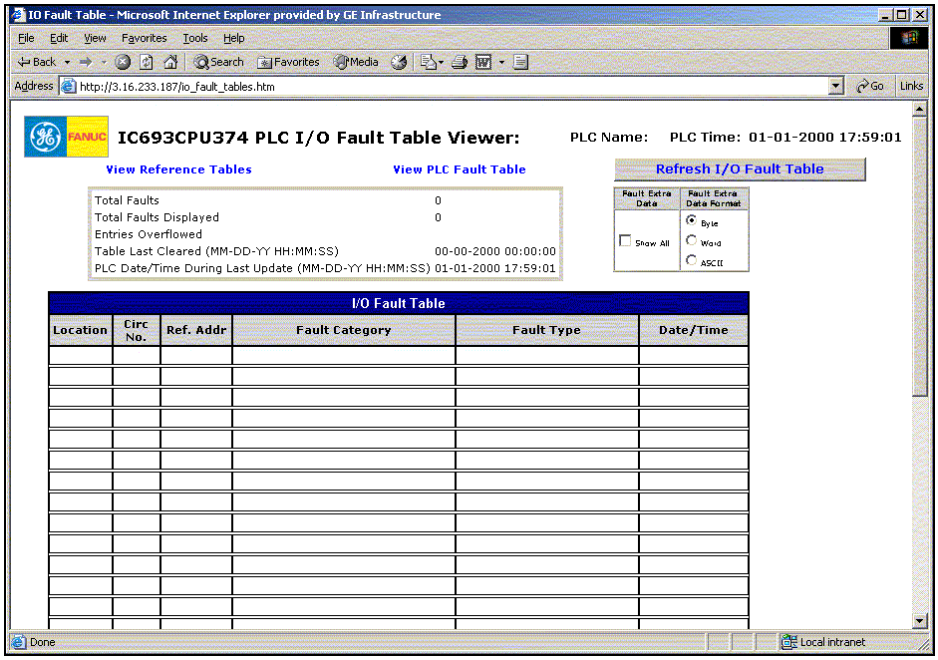
The fault extra data can be displayed in byte, word or ASCII format depending on which button is selected at the top of the screen. These selections affect the display of all fault extra data. If an error code does not have a string associated with it, the “Fault Description” field is blank.

To view the fault extra data for all faults, select the “Show All” checkbox.

For Netscape, first check the “Show All” checkbox and press the “Refresh PLC Fault Table” button. This will show the fault extra data for all faults. Netscape cannot show fault extra data for selected faults. To hide the fault extra data, uncheck the “Show All” checkbox and again press the “Refresh PLC Fault Table” button.

I/O Fault Table Viewer Page

The IO Fault Table web viewer page displays the contents of the I/O Fault Table:



The fault extra data can be shown or hidden by clicking on a fault. The fault extra data for all faults in the table can be displayed by selecting the checkbox at the top of the page labeled ‘Fault Extra Data’. To change the format of the fault extra data, select the appropriate checkbox at the top of the page.

To refresh the fault data, click the ‘Refresh I/O Fault Table’ button.

Downloading PLC Web Pages

To add new or revised web page files or support files, you will need to transfer the appropriate files to the Ethernet Interface via FTP. Once the new web files have been obtained, they are copied into the local computer from which the FTP utility will be run. A general procedure for transferring web files via Windows FTP is described below. (You may also use a commercial FTP program.)

FTP Connect and Login

You can either use a commercial FTP tool or use the “ftp” command on the DOS Prompt or Command line (Note: Not all FTP tools will be guaranteed to work since the server only supports a limited set of FTP commands).

From the Windows DOS box command line interface, enter “ftp” followed by the URL or IP address of the PLC as shown below:

```
ftp <URL or IP address of the Ethernet Interface>
```

You will then be prompted for a login name and password as shown below. The default FTP password is “system”.

```
login: user
password: system
```

The FTP server in the Ethernet interface does not support multiple levels of login (there are no distinct ‘anon’ or ‘user’ logins). Once successfully logged on, your can execute any of the FTP commands described below; this login is required in order to store web page files to the Ethernet interface.

Changing the Password

The default FTP password is “system”. You can change the FTP password via a parameter in the AUP file, which is stored to the PLC via the programmer, or by using the Station Manager.

Changing the Password from the Advanced User Parameters File

The following line should be added to the AUP file to change the FTP password (for example, to “my_ftp_pw”):

```
tpassword = my_ftp_pw
```

Changing the Password from the Station Manager

In addition, you can change the FTP password (for example to “my_ftp_pw”) using the following Station Manager command:

```
= CHPARM  tpassword  my_ftp_pw
```

The FTP password can be up to 10 characters long and uses the same character set listed for the reference viewer password described later in this document. These passwords are not case sensitive.

Arguments for Station Manager CHPARM command must be enclosed in double quotes to preserve the capitalization of the argument. However since these passwords are case insensitive, the double quotes are not required.

Note: The CHPARM command is not available if the PLC has received a valid configuration from the Programmer.

Web Page File Transfer

After logging into the PLC's FTP server, web page files can be copied from the PC to the PLC through the following steps:

1. Set the FTP file transfer type to binary by typing in "binary"
2. For each file, change to the desired directory if appropriate by typing "cd ./subdirectory". Then transfer the file using the "put" command by typing: "put filename.htm"
3. Verify all files are properly transferred by typing in: "dir" or "ls". This returns a list of the files located at the current directory on the PLC Ethernet interface
4. Quit the FTP session by typing in "quit" or "bye".

If you copy a file that already exists in the module, the new file overwrites the existing file without warning. One of the files stored will be a fault string file that will be specific for each language supported.

The PLC FTP server also supports the following standard FTP commands:

- "get" command - allows the user to transfer files from the PLC web server to their local PC (for example "get filename1.htm").
- "delete" command – allows user to delete web pages from the server (for example "delete filename1.htm").

Viewing the CPU374 PLC Web Pages

Each web browser (HTTP) instance (i.e., each browse window) requires at least two TCP connection and each FTP session requires two TCP connections to the PLC. The maximum number of web browser connections and FTP connections at the Ethernet interface at any one time are separately configurable from 0 to 16 (a value of 0 means that the web server or FTP capability is disabled). The total number of configured web browser connections plus FTP connections is limited to 20 connections; once the number of browser/FTP connections reaches the configurable limit, any new browser or FTP connection requests will fail.

The number of Web Server and FTP connections is configurable via the Programmer. The Programmer configuration details are described in the Programmer Help utility.

When the PLC is unconfigured, the user can change the number of web server (HTTP) connections and FTP connections with the following Station Manager commands, respectively:

```
CHSOSW  web_max_conn  <number from 0-16>

CHSOSW  ftp_max_conn  <number from 0-16>
```

For example:

```
= CHSOSW  web_max_conn 6

= CHSOSW  ftp_max_conn 4
```

Note: The CHSOSW commands are not available if the PLC has received a valid configuration from the Programmer.

Chapter 9 Diagnostics

This chapter describes diagnostic techniques for a Series 90-30 CPU374 *PLUS* enhanced Ethernet interface.

- Diagnostic Tools Available for Troubleshooting
- States of the Ethernet Interface
- EOK Blink Codes for Hardware Failures
- PLC Fault Table
- Monitoring the Ethernet Interface Status Bits
- Monitoring the FT Output of the COMMREQ Function Block
- Monitoring the COMMREQ Status Word
- Troubleshooting Common Ethernet Difficulties
- Using the EGD Management Tool

What to do if you Cannot Solve the Problem

If you cannot solve the problem, contact GE Fanuc Automation. Please have the following information ready:

- The Name and Catalog Number marked on the product.
  - PLC CPU version number from Machine Edition Status screen.
  - Ethernet interface type (CPU374 *PLUS* Release 12 or later, embedded).
- Description of symptoms of problem. Depending on the problem, you may also be asked for the following information:
  - The ladder logic application program and the PLC sweep time at the time the problem occurred.
  - A listing of the configuration parameters for the Ethernet interface that failed.
  - A description of the network configuration. This should include the number of PLCs and host computers accessing the network, the type of network cable used (e.g. twisted pair, fiber optic, etc.), length of network cable, and the number and manufacturer of transceivers, hubs, and network switches used.
  - Description on ALL Ethernet communication activity for the PLC.
  - Versions of all software doing Ethernet communication to the PLC.
  - Be prepared to provide the PLC Fault Table showing Fault Extra Data
  - Be prepared to provide Station Manager Log showing Ethernet Events

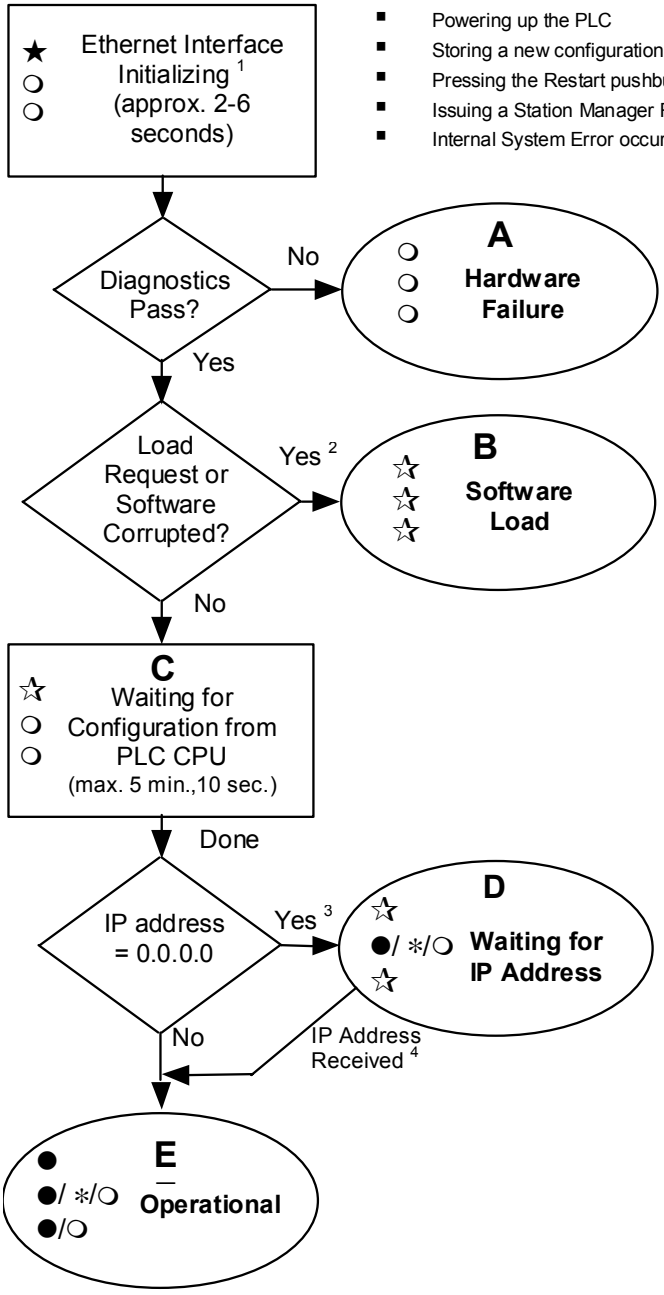
Diagnostic Tools Available for Troubleshooting

There are several tools to assist you in diagnosing problems with the Ethernet interface and the network.

- Use the ***Ethernet Interface LEDs*** to troubleshoot a problem on power-up of the Ethernet interface and for an immediate visual summary of the operational state of the interface.
- Use the PLC Fault Table to troubleshoot a problem once the interface is running. It provides a record of exceptions logged by the PLC, the Ethernet interface, and other I/O and communications modules. The PLC Fault Table is accessed through the PLC programming software or web browser.
- For PLC Fault Table entries generated by the Ethernet interface, the Detailed Fault Data for that entry contains the same data as the corresponding event in the Ethernet interface's exception log. Refer to GFK-2383, *TCP/IP Ethernet Communications for Series 90-30 CPU374 PLUS Station Manager Manual*, for information on how to interpret Ethernet exception log events.
- Use the Ethernet Status Data to troubleshoot the Ethernet interface status
- For Ethernet Global Data operation, the EGD Management Tool can be used to check online operation of the EGD network, as described in this section.
- For Ethernet Global Data operation, Exchange Status words can be used to troubleshoot exchange operations.
- Use the Station Manager to troubleshoot a problem with the Ethernet Interface, the network, PLC backplane communication, or with your application. The LOG, TALLY, EXS, XCHANGE and STAT Station Manager commands are especially useful.
  - The LOG command provides a complete record of exceptions occurring with the network and Interface.
  - The TALLY command provides statistics about operation and performance of the network and Interface.
  - The EXS command provides information about COMMREQs.
  - The CHANNEL command displays detailed information about a specified SRTP communication channel. The STAT H command provides the current status on the operation of SRTP communication channels on the Interface.
  - The XCHANGE command displays detailed information about a specified Ethernet Global Data exchange. The STAT G command provides the current status on the operation of EGD communications on the Interface.

  Refer to GFK-2383, *TCP/IP Ethernet Communications for Series 90-30 CPU374 PLUS Station Manager Manual*, for information on how to access and use the Station Manager software.

States of the Ethernet Interface



1 **The Ethernet Interface is initialized by**

- Powering up the PLC
- Storing a new configuration to the PLC with changes for the Ethernet Interface
- Pressing the Restart pushbutton
- Issuing a Station Manager RESTART command
- Internal System Error occurring when Interface is operational

2 **Software Load caused by**

- Pressing the Restart pushbutton
- Detection of corrupt software

3 **Waiting for IP Address caused by**

- Not configuring Interface using configuration software
- Configuring Interface with IP Address = 0.0.0.0
- New CPU with no configuration
- CPU failure to communication with Interface

4 **Continue to Operational State caused by**

- IP Address received over network

Operational

- Full support for client and server capability
- Uses user-defined Advanced Parameters

Symbols

The LEDs are labeled from top to bottom as follows:
EOK
LAN
STAT

❍	The symbols used for the LEDs in the chart are: OFF
●	ON
☆	Slow Blink; multiple slow blinking LEDS blink in unison
★	Fast Blink
*	Traffic (blinks when there is traffic on the line.
	The process symbols use in this chart are:
□	Temporary condition; requires no intervention
◇	Decision point during powerup
⬭	Interface State; normally the Interface remains in a state unless there is user intervention.

LED Pattern		Where Stopped	Possible Cause	Corrective Actions
❍ ❍ ❍	EOK (OFF) LAN (OFF) STAT (OFF)	A Hardware Failure	Fatal Hardware Error.	Make sure the PLC has power. Examine PLC Fault Table for clues. Recheck PLC Programmer configuration. Power off baseplate, inspect the Interface for loose components, reseat the module, and Restart. If the problem persists, replace the PLC hardware.
✱ ✱ ✱	EOK (Slow blink) LAN (Slow blink) STAT (Slow blink) All LEDs blink in unison.	B Software Loader	Software corrupt.	Connect a PC Software Loader and load new software.
✱ ○ ○	EOK (Slow blink) LAN (OFF) STAT (OFF)	C Waiting for Configuration from PLC	Did not configure slot using the PLC Programmer. CPU not communicating with Ethernet Interface. (Condition can last a maximum of 5 minutes.)	Use the PLC Programmer configuration software to configure the Interface then store the configuration to the PLC CPU. Power cycle the PLC. Clear faults and Restart Interface.
✱ ○ ○	EOK Blinking error code LAN Off STAT Off		Unrecoverable hardware or runtime failure	See the list of blink codes on the next page.
✱ ● ✱ ○ ✱	EOK (Slow blink) LAN (ON/Traffic/OFF) STAT (Slow blink) EOK and STAT blink in unison.	D Waiting for IP Address	Interface's IP address has not been configured or has been configured as 0.0.0.0.	Use the PLC Programmer to configure the Interface with a non-zero IP address. Assign IP address over network
● ● ✱ ○ ● ○	EOK (ON) LAN (ON/Traffic/OFF) STAT (ON/OFF)	E Operational	If the LAN LED is OFF, the problem may be network cable not connected If the STAT LED is OFF, an exception condition has occurred.	Connect cable. Examine PLC Fault Table to find out why the STAT LED is OFF.

EOK LED Blink Codes for Hardware Failures

The EOK LED indicates whether the module is able to perform normal operation. This LED is on for normal operation and flashing for all other operations. If a hardware or unrecoverable runtime failure occurs, the EOK LED blinks a two-digit error code. The EOK LED first blinks to indicate the most significant error digit, then after a brief pause blinks again to indicate the least significant error digit. After a long pause the error code display repeats

Blink Code	***Description***	***Blink Code***	***Description***
0x12	Undefined or Unexpected Interrupt.	0x42	Firmware Loader error
0x13	Timer failure during power up diagnostics.	0x51	Unexpected watchdog timer exception
0x14	DMA failure during power up diagnostics.	0x52	Unexpected debug exception
0x21	RAM failure during power up diagnostics.	0x61	Boot: Critical interrupt exception
0x22	Stack error during power up diagnostics.	0x62	Boot: Machine check exception
0x23	Shared Memory Interface error during power up diagnostics.	0x63	Boot: Data store exception
0x24	Firmware CRC (cyclic redundancy check) error during power up or Factory Test*	0x64	Boot: Instruction store exception
0x25	Run time exception	0x65	Boot: External interrupt exception
0x26	No mail communication available during software load	0x66	Boot: Alignment exception
0x27	Serial EEPROM access exception	0x67	Boot: Program exception
0x28	Serial EEPROM reset exception	0x68	Boot: System call exception
0x31	Machine check exception	0x69	Boot: PIT interrupt exception
0x32	Data store exception.	0x71	Boot: FIT interrupt exception
0x33	Instruction store exception	0x72	Boot: WDT interrupt exception
0x34	Alignment exception	0x73	Boot: Data cache TLB miss exception
0x35	Program exception	0x74	Boot: Instruction cache TLB miss exception
0x36	System call exception	0x75	Boot: Debug exception
0x37	Unexpected IRQ exception	0x76	Boot: Flash memory CRC error
0x38	Data cache TLB miss exception	0x77	Boot: Unexpected ACFAIL interrupt
0x39	Instruction cache TLB miss exception	0x78	Boot: Unexpected Restart pushbutton interrupt
0x41	BSP startup error		

*CRC error or software error during normal operation causes Ethernet restart

PLC Fault Table

Most error conditions involving the Ethernet interface generate faults in the PLC Fault table. The table on the next two pages lists Ethernet interface faults and corrective actions.

To access the details of a PLC Fault Table entry, double-click the Fault Table entry and the details are displayed as “fault extra data”. Refer to Online Help in the PLC programming software for more information.

An example of the fault extra data is shown below:

```
16000600030005000000000000000000000000000000000000
| |    |    |   |
```

For the Ethernet interface, the leftmost 14 digits of fault extra data (underlined in the example above) show the corresponding log Events (2 digits) and Entries 2, 3, and 4 (in that order, 4 digits each). The example above is reporting an Event 16, Entry 2=6, Entry 3=3, and Entry 4=5.

This information can be used to refer directly to detailed fault descriptions included in the Exception Log Event tables in GFK-2383, *TCP/IP Ethernet Communications for Series 90-30 CPU374 PLUS Station Manager Manual.* (In that document, refer to Appendix B, Exception Log Events.)

PLC Fault Table Descriptions

PLC Fault	User Action
Backplane communications with PLC fault; lost request	Check to make sure that the logic application is not sending COMMREQs faster than the Ethernet Interface can process them. Reduce the rate at which the application is sending COMMREQs to the Ethernet interface. If problem persists, contact GE Fanuc Automation.
Bad local application request; discarded request	Check for valid COMMREQ command code. If problem persists, contact GE Fanuc Automation.
Bad remote application request; discarded request	Try to validate the operation of the remote node. If problem persists, contact GE Fanuc Automation.
Can't locate remote node; discarded request	Error reported when message received where IP/MAC address cannot be resolved. Error may indicate that remote host is not operational on the network. Check that remote host is operational on network and its addresses are correct.
Comm_req - Bad task ID programmed	Message from PLC for unknown Ethernet Interface task. Check COMMREQ function block.
Comm_req - Wait mode not allowed	Check COMMREQ to make sure sent in no-wait mode.
Configured gateway address bad; can't talk off local net	Error in configuration. Verify that IP address, Subnetwork Mask, and default Gateway IP address are correct.
Connection to remote node failed; resuming without it	Underlying communications software detects error transferring data; resuming. If persistent error, check connection to LAN and operation of remote node.
LAN controller fault; restart LAN I/F	HW fault, perform a power cycle. If problem persists, contact GE Fanuc Automation.
LAN controller Tx underflow; attempt recovery	Internal system error. If problem persists, contact GE Fanuc Automation.
LAN controller under run/overrun; resuming	Internal system error. If problem persists, contact GE Fanuc Automation.
LAN data memory exhausted - check parameters; resuming	The Ethernet Interface does not have free memory to process communications. If problem persists, contact GE Fanuc Automation.
LAN duplicate MAC Address; resuming	A frame was received in which the source MAC Address was the same as this station's MAC Address. All stations on a network must have a unique MAC address. Immediately isolate the offending station; it may be necessary to turn it off or disconnect it from the network. This station remains Online unless you intervene to take it Offline.
LAN I/F can't init - check parameters; running soft Sw utl	Internal system error. If problem persists, contact GE Fanuc Automation.
LAN I/F capacity exceeded; discarded request	Verify that connection limits are not being exceeded.
LAN interface hardware failure; switched off network	Replace the Ethernet Interface.

PLC Fault	User Action
LAN network problem exists; performance degraded	Excessive backlog of transmission requests due to excessive traffic on the network. For a sustained period the MAC was unable to send frames as quickly as requested. If problem persists, contact GE Fanuc Automation.
LAN severe network problem; attempting recovery	External condition prevented transmission of frame in specified time. Could be busy network or network problem. Check transceiver to make sure it is securely attached to the network.
LAN system-software fault; aborted connection resuming	Internal system error. If problem persists, contact GE Fanuc Automation.
LAN system-software fault; restarted LAN I/F	Internal system error. If problem persists, contact GE Fanuc Automation.
LAN system-software fault; resuming	Internal system error. If problem persists, contact GE Fanuc Automation.
LAN transceiver fault; OFF network until fixed	Transceiver or transceiver cable failed or became disconnected. Reattach the cable or replace the transceiver cable. Check SQE test switch if present on transceiver.
Local request to send was rejected; discarded request	Internal error. Check that the Ethernet Interface is online. If problem persists, contact GE Fanuc Automation.
Memory backup fault; may lose configuration/log on restart	Internal error accessing non-volatile device. If problem persists, contact GE Fanuc Automation - NA. Replace Ethernet Interface.
Module software corrupted; requesting reload	Catastrophic internal system error. Contact GE Fanuc Automation.
Module state doesn't permit Comm_Req; discarded	COMMREQ received when Ethernet Interface cannot process COMMREQ. Make sure Ethernet Interface is configured and online. Error may occur if the logic application is sending COMMREQs faster than the Ethernet Interface can process them. Reduce the rate at which COMMREQs are sent.
Unsupported feature in configuration	PLC firmware does not support Ethernet communications software or attempt has been made to configure a feature not supported by the Ethernet Interface. Check CPU and Ethernet Interface revisions, order upgrade kit for CPU and/or Ethernet Interface.
Can't locate remote node; discarded request	A specified remote device does not exist on the network. Check that the remote device IP address is correct and that the remote device is functioning properly.
Mailbox Queue full – Comm_req aborted	The CPU is attempting to send COMMREQs faster than the Ethernet Interface can receive them. The PLC logic program should retry the COMMREQ after a short delay. If the condition persists, the logic application should be revised to reduce the rate at which it sends COMMREQs to the Ethernet Interface.
Non-critical CPU software event	The CPU is attempting to send mail messages faster than they can be retrieved by the Ethernet Interface; the messages are discarded. This can result in subsequent "Backplane communications with PLC fault; lost request" faults.

Monitoring the Ethernet Interface Status Bits

The Ethernet Interface Status bits normally occupy a single block of memory. The memory location is specified during configuration of the Ethernet interface. The status bits are updated in the CPU once each PLC scan by the Ethernet interface. These bits are generally used to prevent initiation of a COMMREQ function when certain errors occur.

The first 16 bits of the block are the LAN Interface Status (LIS) bits. The next 32 bits are the Channel Status bits (2 for each channel). Bits 48-80 are reserved. Unless the "LAN Interface OK" bit is set (Status Bit 16), the other status bits are invalid.

Status Bits	***Brief Description***
1	Port 1 full duplex
2	Port 1 100Mbps
3	Port 2 full duplex
4	Port 2 100 Mbps
5-8	Reserved
9	Any Channel Error (error on any channel)
10–12	Reserved
13	LAN OK
14	Resource problem
15	Module Overtemperature (RX3i only)
16	LAN Interface OK
17	Channel 1 Status (SRTP: Data Transfer)
18	Channel 1 Status (SRTP: Channel Error)
...	...
47	Channel 16 Status (SRTP: Data Transfer)
48	Channel 16 Status (SRTP: Channel Error)
49-80	Reserved

LAN Interface Status (LIS) Bits

The LAN Interface Status bits monitor the health of the Ethernet interface itself.

Bit 1, Port 1 Full Duplex: This bit is set to 1 when Port 1 is set to full duplex. Full-duplex or half-duplex operation is automatically negotiated between the Ethernet interface and its immediately-connected network device, usually a network hub or switch. If this bit is 0, the port is in half-duplex Ethernet mode. This bit is only valid if bit 13 (LAN OK) is 1.

Bit 2, Port 1 100Mbps: This bit is set to 1 when Port 1 is operating at 100Mbps.

Bit 3, Port 2 Full Duplex: This bit is set to 1 when Port 2 is set to full duplex. Full-duplex or half-duplex operation is automatically negotiated between the Ethernet interface and its immediately-connected network device, usually a network hub or switch. If this bit is 0, the port is operating in half-duplex Ethernet mode. This bit is only valid if bit 13 (LAN OK) is 1.

Bit 4, Port 2 100Mbps: This bit is set to 1 when Port 2 is operating at 100Mbps.

Bit 9, Any Channel In Error: This bit (normally 0) indicates one or more of the channels are in error.

Bit 13, LAN OK: This bit is 1 as long as the Ethernet interface software is able to communicate on the network. If the network becomes inaccessible due to local or network problems, this bit is set to 0. If LAN communication becomes possible again, it is set to 1.

Bit 14, Resource Problem: This bit is set to 1 if the Ethernet interface software has a resource problem (i.e., lack of data memory). The bit is reset to 0 on a subsequent PLC sweep. The Ethernet interface may or may not be able to continue functioning, depending on the severity of the problem. Look in the PLC Fault Table for details. In addition, the Station Manager STAT B and LOG commands can be used. See the *TCP/IP Ethernet Communications for Series 90-30 CPU374 PLUS Station Manager Manual*, GFK-2383, for more information.

Bit 15, Reserved

Bit 16, LAN Interface OK Bit: This bit is set to 1 by the Ethernet interface each PLC scan. If the Ethernet Interface cannot access the PLC, the CPU sets this bit to 0. *When this bit is 0, all other Ethernet Interface Status bits are invalid.*

Channel Status Bits

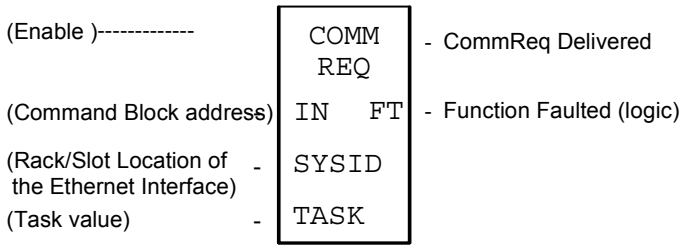
The Channel Status bits provide runtime status information for each communication channel. Each channel has two status bits; the meaning of the channel status bits depends upon the type of communication performed on that channel.

SRTP Client (channels) operation provides two Channel Status bits for each SRTP channel, a Data Transfer bit and a Channel Error bit. These are defined in chapter 6, SRTP Channels.

Bits 17, 19, 21 ... 47, Data Transfer Bit: The Data Transfer bit pulses ($0 \rightarrow 1 \rightarrow 0$) each time there is a successful read or write. **Bits 18, 20, 22 ... 48, Channel Error Bit:** This bit (normally 0) indicates any channel error, fatal or non-fatal. It does not necessarily indicate that the channel is idle.

Monitoring the FT Output of the COMMREQ Function Block.

The COMMREQ function block indicates its status through its FT output:



If after executing a COMMREQ Function, the FT Output is ON, there is a programming error in one or more of the following areas.

- Invalid rack/slot specified. The module at this rack/slot is unable to receive a COMMREQ Command Block.
- Invalid Task ID.
- Invalid Data Block length (0 or greater than 128).

This output also may indicate that no more COMMREQ functions can be initiated in the ladder program until the Ethernet interface has time to process some of the pending COMMREQ functions.

If the FT Output is set, the CPU did not transfer the Command Block to the Ethernet interface. In this case, the other status indicators are not updated for this COMMREQ. The Ethernet interface is unable to return a COMMREQ Status Word to the PLC logic application.

Monitoring the COMMREQ Status Word

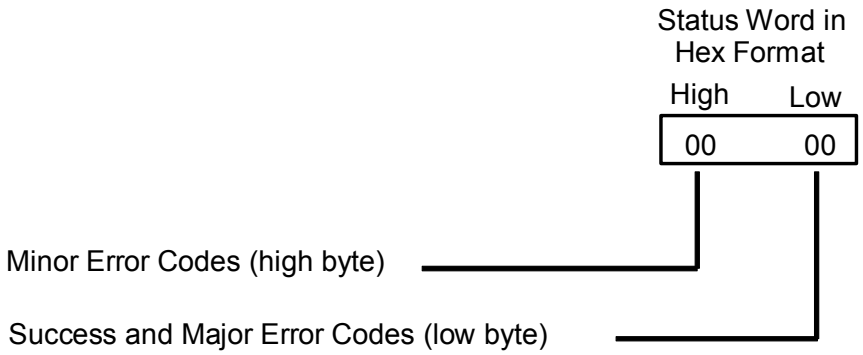
Every COMMREQ Command Block instruction specifies a 1-word memory address to receive status information about the execution of the command.

Before executing a COMMREQ for the Ethernet interface, the application program logic should the associated status word zero (for example, using a MOVE Word instruction). After executing a COMMREQ, the program should monitor its status word. If the status word is updated to a one (1), the command has been processed successfully. If the status word is updated to a value other than 1, an error has occurred. Any data returned by that command should not be used until the problem is corrected and the status word indicates success. It is critical to monitor the COMMREQ status word for each COMMREQ function. .

If after executing a COMMREQ function, the COMMREQ status word is zero (0), the success Output is ON and the FT Output is OFF, the Command Block has been sent to the Ethernet interface, but no status has been returned. If this condition persists, check the PLC Fault Table for information.

Format of the COMMREQ Status Word

Displaying the status word in hexadecimal form makes it easier to differentiate the high and low bytes. This can be done using a MOVE WORD function block to display the hexadecimal value within the ladder program.



The following tables list the error codes that are reported in the COMMREQ Status word after the execution of a COMMREQ function.

Major Error Codes in the COMMREQ Status Word

Success or a Major Error Code appears in the low byte of the COMMREQ Status Word. Hexadecimal values for the low byte are listed below. For many Major Error Codes, additional information appears as a Minor Error Code in the high byte of the COMMREQ Status Word. Hexadecimal values for the high byte are listed on the following pages.

Error Status (Hexadecimal)	Major Error Description
01H	Successful Completion. (This is the expected completion value in the COMMREQ Status word.)
02H	Insufficient Privilege at server PLC
04H	Protocol Sequence Error. The server CPU has received a message that is out of order. *Call GE Fanuc Automation for assistance.*
05H	Service Request Error at server PLC. The minor error code contains the specific error code. See the following table of Minor Error codes.
06H	Illegal Mailbox Type at server PLC. Service request mailbox type is either undefined or unexpected. *Call GE Fanuc Automation for assistance.*
07H	The server PLC CPU's Service Request Queue is full, usually due to heavy CPU loading. The client should retry later. It is recommended that the client wait a minimum of 10 milliseconds before sending another service request.
0BH	Illegal Service Request. The requested service is either not defined or not supported at the server PLC. (This value is returned in lieu of the actual service request error (01H), to avoid confusion with the normal successful COMMREQ completion.) *Call GE Fanuc Automation for assistance.*
11H	SRTP Error Code at server. An error was detected at the SRTP server. See the following table of Minor Error codes.
82H	Insufficient Privilege at client PLC. The minor error code contains the privilege level required for the service request.
84H	Protocol Sequence Error. The CPU has received a message that is out of order. *Call GE Fanuc Automation for assistance.*
85H	Service Request Error at the client PLC. The minor error code contains the specific error code. See the following table of Minor Error codes.
86H	Illegal Mailbox Type. Service request mailbox type is either undefined or unexpected. *Call GE Fanuc Automation for assistance.*
87H	The client PLC CPU's Service Request Queue is full. The client should retry later. It is recommended that the client wait a minimum of 10 milliseconds before sending another service request.
8BH	Illegal Service Request. The requested service is either not defined or not supported. (This value is returned in lieu of the actual service request error (01H), to avoid confusion with the normal successful COMMREQ completion.). *Call GE Fanuc Automation for assistance.*
90H	SRTP Client (Channels) error. See the following table of Minor Error codes. (Some EGD command errors also use major code 90 when indicating the same error condition as SRTP channels.)
A0H	EGD Command error. See the following table of Minor Error codes.

Minor Error Codes for Major Error Codes 05H (at Remote Server PLC) and 85H (at Client PLC)

Error Status (Hexadecimal)		Error Description
Remote Server	**Client**	
8F05H	8F85H	Session already exists.
8E05H	8E85H	Memory write is prohibited.
9005H	9085H	Invalid PLC memory reference range.
9305H	9385H	Text buffer length/count does not agree with request parameters.
C105H	C185H	Invalid block state transition.
C305H	C385H	Text length does not match traffic type.
C605H	C685H	Control Program (CP) tasks exist but requestor not logged into main CP.
C705H	C785H	Passwords are set to inactive and cannot be enabled or disabled.
C805H	C885H	Password(s) already enabled and cannot be forced inactive.
C905H	C985H	Login using non-zero buffer size required for block commands.
CA05H	CA85H	Device is write-protected.
CB05H	CB85H	A comm or write verify error occurred during save or restore.
CC05H	CC85H	Data stored on device has been corrupted and is no longer reliable.
CD05H	CD85H	Attempt was made to read a device but no data has been stored on it.
CE05H	CE85H	Specified device has insufficient memory to handle request.
CF05H	CF85H	Specified device is not available in the system (not present).
D105H	D185H	Packet size or total program size does not match input.
D205H	D285H	Invalid write mode parameter.
D505H	D585H	Invalid block name specified.
D605H	D685H	Total datagram connection memory exceeded.
D705H	D785H	Invalid datagram type specified.
D805H	D885H	Point length not allowed.
D905H	D985H	Transfer type invalid for this Memory Type selector.
DA05H	DA85H	Null pointer to data in Memory Type selector.
DB05H	DB85H	Invalid Memory Type selector in datagram.
DC05H	DC85H	Unable to find connection address.
DD05H	DD85H	Unable to locate given datagram connection ID.
DE05H	DE85H	Size of datagram connection invalid.
DF05H	DF85H	Invalid datagram connection address.

continued

Minor Error Codes for Major Error Codes 05H (at Remote Server PLC) and 85H (at Client PLC)

Continued from previous page

Error Status (Hexadecimal)		Error Description
Remote Server	**Client**	
E005H	E085H	Service in process cannot login.
E405H	E485H	Memory Type for this selector does not exist.
E905H	E985H	Memory Type selector not valid in context.
EA05H	EA85H	Not logged in to process service request.
EE05H	EE85H	Could not return block sizes.
EF05H	EF85H	Programmer is already attached.
F005H	F085H	Request only valid in stop mode.
F105H	F185H	Request only valid from programmer.
F205H	F285H	Invalid program cannot log in.
F405H	F485H	Invalid input parameter in request.
F505H	F585H	Invalid password.
F605H	F685H	Invalid sweep state to set.
F705H	F785H	Required to log in to a task for service.
F805H	F885H	Invalid program name referenced.
F905H	F985H	Task address out of range.
FC05H	FC85H	I/O configuration is invalid.
FE05H	FE85H	No privilege for attempted operation.
FF05H	FF85H	Service request has been aborted.

Minor Error Codes for Major Error Code 11H (at Remote Server PLC)

Error Status (Hexadecimal)	SRTP Error Description
0111H	Generic SRTP error.
0211H	The PLC is inaccessible.
0311H	Reserved.
0411H	Unexpected SRTP version encountered in received message.
0511H	Unrecognized SRTP message received.
0611H	Data present in SRTP message which should not contain data.
0711H	Generic resource problem detected.
0811H	SRTP message encountered in inappropriate connection state.
0911H	Generic refusal by backplane driver to handle request.
0A11H	Recognized but unsupported SRTP message received.
0B11H	Lost transaction in server.
0C11H	Error sending SRTP PDU to the client PLC.
1411H	Unable to allocate a text buffer from dual port memory.
1711H	Invalid text length detected in a mailbox message.
1811H	Invalid number of destinations detected in a mailbox message.
1911H	Invalid source detected in a mailbox message.
1A11H	Invalid slot number detected in a mailbox message.
1B11H	Invalid rack number detected in a mailbox message.
1D11H	Bad text buffer address in dual port memory.
2111H	Unable to find control data required to send a mailbox message to the PLC.
2211H	Timed out waiting for availability of mail communications with the PLC.
2311H	Invalid task ID detected while attempting to send a mailbox message to the PLC.
2411H	Unable to send mailbox message to PLC because the mail queue is full.
2611H	Unable to communicate with PLC.
2711H	Backplane driver not initialized or unable to acquire a dual port memory semaphore.
2A11H	The backplane driver could not access the PLC.
2B11H	Invalid binding on the message sent to the backplane driver.
2C11H	The message could not be sent to its destination because the mailbox was not open.
2D11H	The maximum number of transfers to the destination is already taking place.
2E11H	The maximum number of transfers of this transfer type is already taking place.
2F11H	Cannot obtain a backplane transfer buffer.

continued

Minor Error Codes for Major Error Code 11H (at Remote Server PLC)

Continued from previous page

Error Status (Hexadecimal)	SRTP Error Description
3011H	Cannot obtain resources other than backplane transfer buffers.
3111H	Connection ID or block transfer ID is not valid.
3211H	Timed out waiting for PLC CPU response.
3311H	The PLC CPU aborted the request.
3411H	An invalid message type was specified.
3511H	The specified task is not registered.
3611H	The mailbox offset specified is invalid.
3711H	The backplane task could not be registered because the message response handler was not specified.
3811H	The backplane task could not be registered because the unsolicited mailbox message handler was not specified.
3911H	The backplane task could not be registered because a required parameter was not specified.
3A11H	More than the allowable byte length in a single transfer.
3B11H	Bad sequence number in the request.
3C11H	Invalid command in request.
3D11H	Response length does not match length specified in the response qualifier.
3E11H	Request failed because the PLC's Service Request Processor is not initialized.
3F11H	Request failed due to an error in the remote device, most likely running out of Dual-Port RAM text buffers.
4011H	Unable to free dual port memory that was allocated for a connection or block transfer area.
4111H	The backplane task could not be registered because the service request handler was not specified.
4211H	No dual port memory was allocated for the connection or block transfer area needed to process the request.
4311H	Failure to register with backplane driver because the requested task is already registered.
4411H	Request failed because an invalid field was identified in the request mailbox qualifier.

continued

Minor Error Codes for Major Error Code 11H (at Remote Server PLC)

Continued from previous page

Error Status (Hexadecimal)	SRTP Error Description
E811H	Unable to send request to the PLC because an internal message queue is full.
E911H	Unable to send request to the PLC because the text buffer type is invalid.
EA11H	Unable to send request to the PLC because the mailbox utility function is invalid.
EB11H	Unable to send request to the PLC because the mailbox message is not specified.
EC11H	Unable to send request to the PLC because the internal message queue is not initialized.
FE11H	Request failed due to mailbox error on remote device. The remote device log will have more information.
2911H	The backplane driver is not initialized.
2A11H	The backplane driver could not access the PLC.
2F11H	Request failed due to an invalid parameter detected in the remote device. The remote device log will have more information.
3011H	The specified task is not registered.
3111H	Failure to register with backplane driver because the requested task is already registered.
3211H	Unable to find resource necessary for backplane driver to process a service request.
3311H	Bad sequence number detected in the service request because it is already in use.
3411H	Invalid data detected that prevents backplane driver from completing a request.
3611H	More than the allowable byte length in a single transfer.
4811H	Memory resource problem detected.
4911H	Network buffer resource problem detected.
4C11H	Error detected while attempting to receive mailbox messages from the PLC.
4D11H	Timed out waiting to obtain a backplane transfer buffer.
4E11H	Timed out waiting to transfer a mailbox message to the PLC.
4F11H	Timed out waiting for PLC CPU response.

Minor Error Codes for Major Error Code 90H (at Client PLC)

Error Status (Hexadecimal)	Error Description
0190H	Timeout expired before transfer completed; still waiting on transfer.
0290H	Period expired before transfer completed; still waiting on transfer.
8190H	COMMREQ data block too short for the command.
8290H	COMMREQ data block too short for server PLC node address.
8390H	Invalid server memory type.
8490H	Invalid Program Name.
8590H	Invalid Program Block Name.
8690H	Zero server unit length is not allowed.
8790H	Server unit length is too large.
8890H	Invalid channel number.
8990H	Invalid time unit for period. (Maximum permitted 3965 hours)
8A90H	Period value is too large.
8B90H	Zero server memory starting address is not allowed.
8C90H	Invalid client memory type.
8D90H	Invalid server host address type.
8E90H	Invalid IP address integer value. (Must be 0–255)
8F90H	Invalid IP address class. (Must be valid Class A, B, or C IP address) May also occur if the destination IP address in the COMMREQ is same as the sender's IP address.
9090H	Insufficient TCP connection resources to do request.
9190H	Zero local starting address is not allowed.
9290H	Address length value invalid. Must be 4 for address type 1.
9390H	COMMREQ data block too short for Program Block name (including 0 pad).
9490H	COMMREQ data block too short for Program name (including 0 pad).
9590H	Internal API error. See PLC Fault Table or exception log for details. This problem may occur due to the Ethernet Interface being asked to perform beyond its capacity. Try transferring less data per message or establishing fewer simultaneous connections.
9690H	Underlying TCP connection aborted (reset) by server end point.
9790H	Underlying TCP connection aborted by client end point.
9890H	The remote server has no Service Request Processor.
9A90H	Response to session request did not arrive in proper order.
9B90H	Session denied by server PLC.
9C90H	Data response did not arrive in proper order.
9D90H	Data response had unexpected size.
9E90H	Unrecognized COMMREQ command code.

continued

Minor Error Codes for Major Error Code 90H (at Client PLC)

Continued from previous page

Error Status (Hexadecimal)	Error Description
A190H	Invalid CRS word memory type.
A290H	Failed an attempt to update the CRS word.
A390H	*Reserved.*
A490H	*Reserved.*
A590H	*Reserved.*
A690H	Invalid bit mask.
A790H	Unable to connect to remote device.
A890H	Channel Resources in Use. Try the command again; a resource will become available.
A990H	"Establish Read/Write/Send Info Report Channel" COMMREQ was received while an Abort was in progress.
AA90H	An attempt to establish a TCP connection with a Remote Server has failed. Check the following: ▪ Make sure the Server is turned on. ▪ Make sure cables are connected. ▪ If using a switch, make sure the switch is turned on.
AB90H	A COMMREQ was discarded because the application program issued the COMMREQ before the COMMREQ Status Word for the previous COMMREQ was set.
AC90H	A protocol error occurred while communicating with the local PLC.
AD90H	A TCP Timeout occurred while communicating with the Remote PLC.
AE90H	A protocol error occurred while communicating with the local PLC.
B090H	Network Address name length error. The name cannot exceed 31 ASCII characters and must be terminated with a NUL character (zero).
B190H	Specified Network Address name could not be resolved into an IP address.
B390H	Internal name resolution error. See PLC Fault Table or exception log for details.
B590H	The channel the application is trying to access is owned by a different protocol.
FF90H	Abort in Progress on a Channel

Minor Error Codes for Major Error Code A0H (at Client PLC)

Error Status (Hexadecimal)	Error Description
01A0H	Remote exchange is not healthy.
02A0H	Remote exchange is not defined.
03A0H	Remote exchange signature does not match.
04A0H	Request data length is invalid.
05A0H	Response data length is invalid.
06A0H	Invalid memory type selector or address range at remote device.
07A0H	Password protection does not permit access at remote device.
08A0H	Attempt to write to a consumed exchange; this is not permitted.
09A0H	Internal resource error at remote device (memory allocation failed, etc.)
0AA0H	Message delivery error; command was not processed.
0BA0H	Software initialization error; command was not processed.
0CA0H	Invalid RDS session was specified.
0DA0H	Data buffer length is invalid.
0EA0H	Invalid response message from remote device.
0FA0H	Address type is not supported at remote device.
10A0H	A memory access error occurred while processing this command.
11A0H	Remote device did not understand the request.
12A0H	Remote device has no variable defined at the specified address.
13A0H	An attempt was made to write a Read-Only variable at remote device.
14A0H	Data length or contents are invalid for transfer according to the data type of that variable at remote device.
15A0H	Response message would exceed max response size (1400 bytes).
50A0H	The remote server detected an unsupported protocol version in the request.
51A0H	The remote server did not recognize the requested command.
52A0H	The remote server detected a configuration time mismatch in the request.
53A0H	The remote server detected that the request was not a valid RDS message. The RDS_Header bit (required by RDS version 2.01 and higher) was not set.
54A0H	Attempt to establish a second session to a remote server. Only one session at a time is permitted between this device and each remote server.

Using the EGD Management Tool

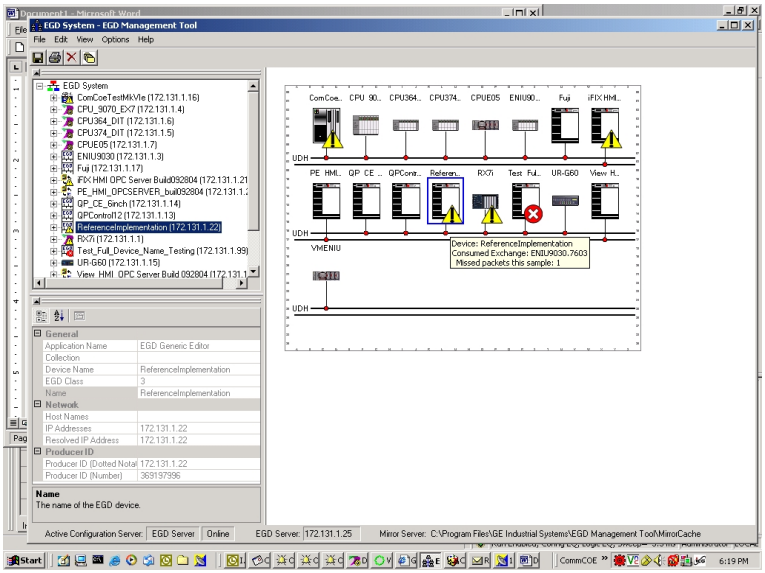
The EGD Management Tool can perform online monitoring of EGD class 2 devices such as the CPU374 *PLUS* enhanced Ethernet interface, and PACSystems Ethernet Interfaces. It can quickly look at the Ethernet Global Data traffic across an entire network of EGD devices to spot problems. To use the EGD Management Tool, you must have configured Ethernet Global Data using the EGD Configuration Server option as described in chapter 3.

Installing the EGD Management Tool

The EGD Management Tool is not automatically installed when you install the Programmer. To install the EGD Management Tool, look in the directory where you installed the programmer and you will find a subdirectory named “EGD Installs”. In that directory, you will find a file named “EgdManagementToolSetup.msi”. Double-click on this file to install the EGD Management Tool.

Launching the EGD Management Tool

To run the EGD Management Tool, select the Ethernet Global Data node in the Navigator and right click. Select ”Launch EGD Management Tool”. The EMT will begin execution in a separate frame on your desktop.



The right side of the screen shows a graphical representation of the EGD network based on the configuration data stored in the EGD Configuration Server. EGD collections are displayed as a folder icon. The navigator on the left side allows specific devices, exchanges and variables in the configuration to be examined. Properties for these elements are shown in the property pane at the lower left.

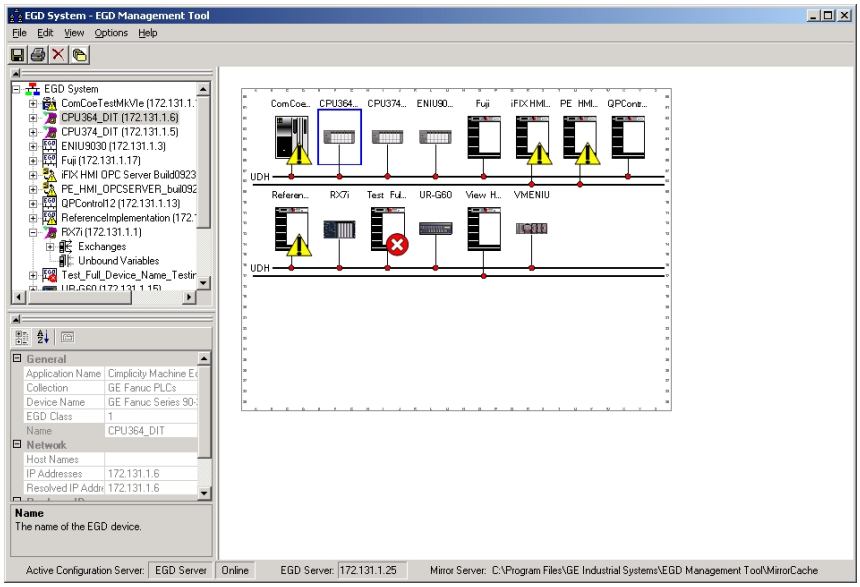
The EGD Management Tool displays devices and networks based on the configuration information in the EGD Configuration Server for the machine it is running on. Using the options menu you can configure the server information much as you do for the programming tool, and also set options for the online operation of the tool. Be aware that changing the server configuration will change it for all tools running on that machine, including the programming software.

In addition to the online operations described below, the EGD Management Tool has a number of offline capabilities (such as View/Reports) for doing analysis of the Ethernet Global Data configuration. See the EGD Management Tool help for more information.

Monitoring EGD Devices

The EGD Management Tool monitors the devices on the Ethernet Global Data network provided it has access to that network. To have access to the EGD network, the computer running the EGD Management Tool must have a Network Interface Card that connects to the EGD network. Consult with your local network administrator if you need help connecting the computer to the Ethernet Global Data network.

The screen below shows the EGD Monitoring Tool connected to and monitoring an EGD network.



Devices that have a red ‘x’ are not responding to communications from the EGD Management Tool. Devices that have a yellow triangle have some kind of error or warning condition that may require attention. Use the browser pane to select the device to get further information about the failures being reported. The EGD Management Tool reports a configuration mismatch for PLCs that have multiple Ethernet interfaces. Only one of the interfaces in a PLC is queried by the EGD Management Tool, so only a subset of the exchanges in the PLC is visible online through that interface.

Online information is only available for EGD Class 2 devices (devices that support the EGD commands). This includes the CPU374 Release 12 or later embedded Ethernet interface and all PACSystems controllers. It does not include prior versions of the Series 90-30 CPU374, or most other GE Fanuc Series 90 PLCs.

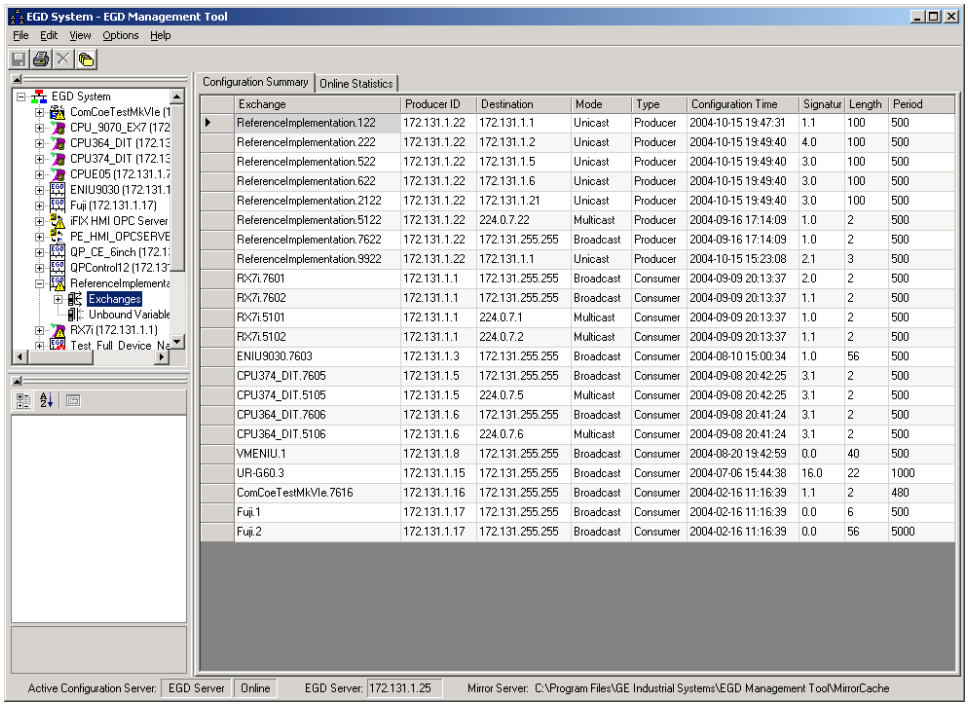
When the EGD Management Tool is used online, it periodically sends Ethernet Global Data commands to each device. This may have a performance impact on the network and the devices on the network. Before using the EGD Management Tool in a production environment, be sure to assess the performance impact of its use on your application.

Monitoring Status of Ethernet Global Data for a Device

The EGD Management Tool can display detailed information for each exchange in an EGD Class 2 device. Selecting the Exchanges node for the device in the navigator pane will display the list of exchanges for the device.

Configuration Summary

Selecting the “Configuration Summary” tab displays information about the exchanges defined in the device.



The configuration summary data for each exchange has the following information:

Exchange –the name of the exchange as it is stored in the EGD configuration server.

Producer ID –the producer ID of the exchange as it is stored in the EGD configuration server.

Destination –the destination IP address for the exchange.

Mode – ‘Unicast’, ‘Multicast’ or ‘Broadcast’ based on the mode of the exchange.

Type – ‘Producer’ or ‘Consumer’ depending on the type of the exchange.

Configuration Time –the configuration timestamp of the exchange as it is stored in the EGD configuration server.

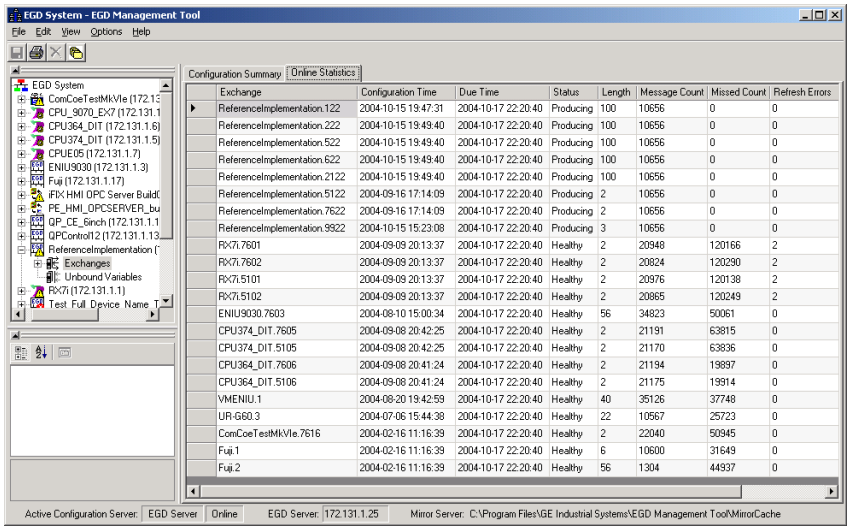
Signature –the signature value of the exchange as it is stored in the EGD configuration server.

Length –the byte size of the exchange as it is stored in the EGD configuration server.

Period –the production period for a produced exchange or the consume timeout for a consumed exchange as it is stored in the EGD configuration server.

Online EGD Statistics

Selecting the “Online Statistics” tab displays a list of the exchanges in the device and statistics information about each exchange. The statistics are updated periodically based on a rate in the Options menu.


EGD System - EGD Management Tool
File Edit View Options Help
Configuration Summary
Online Statistics
Active Configuration Server: EGD Server Online EGD Server: 172.131.1.25 Mirror Server: C:\Program Files\GE Industrial Systems\EGD Management Tool\MirrorCache

Exchange	Configuration Time	Due Time	Status	Length	Message Count	Missed Count	Refresh Errors
ReferenceImplementation.122	2004-10-15 19:47:31	2004-10-17 22:20:40	Producing	100	10656	0	0
ReferenceImplementation.222	2004-10-15 19:49:40	2004-10-17 22:20:40	Producing	100	10656	0	0
ReferenceImplementation.522	2004-10-15 19:49:40	2004-10-17 22:20:40	Producing	100	10656	0	0
ReferenceImplementation.622	2004-10-15 19:49:40	2004-10-17 22:20:40	Producing	100	10656	0	0
ReferenceImplementation.2122	2004-10-15 19:49:40	2004-10-17 22:20:40	Producing	100	10656	0	0
ReferenceImplementation.5122	2004-09-16 17:14:09	2004-10-17 22:20:40	Producing	2	10656	0	0
ReferenceImplementation.7622	2004-09-16 17:14:09	2004-10-17 22:20:40	Producing	2	10656	0	0
ReferenceImplementation.9922	2004-10-15 15:23:08	2004-10-17 22:20:40	Producing	3	10656	0	0
RX7i.7601	2004-09-09 20:13:37	2004-10-17 22:20:40	Healthy	2	20948	120166	2
RX7i.7602	2004-09-09 20:13:37	2004-10-17 22:20:40	Healthy	2	20824	120290	2
RX7i.5101	2004-09-09 20:13:37	2004-10-17 22:20:40	Healthy	2	20976	120138	2
RX7i.5102	2004-09-09 20:13:37	2004-10-17 22:20:40	Healthy	2	20865	120249	2
ENIU9030.7603	2004-08-10 15:00:34	2004-10-17 22:20:40	Healthy	56	34823	50061	0
CPU374_DIT.7605	2004-09-08 20:42:25	2004-10-17 22:20:40	Healthy	2	21191	63815	0
CPU374_DIT.5105	2004-09-08 20:42:25	2004-10-17 22:20:40	Healthy	2	21170	63836	0
CPU364_DIT.7606	2004-09-08 20:41:24	2004-10-17 22:20:40	Healthy	2	21194	19897	0
CPU364_DIT.5106	2004-09-08 20:41:24	2004-10-17 22:20:40	Healthy	2	21175	19914	0
VMENIU.1	2004-08-20 19:42:59	2004-10-17 22:20:40	Healthy	40	35126	37748	0
UR-G60.3	2004-07-06 15:44:38	2004-10-17 22:20:40	Healthy	22	10567	25723	0
ComCoeTestMkVIe.7616	2004-02-16 11:16:39	2004-10-17 22:20:40	Healthy	2	22040	50945	0
Fuji.1	2004-02-16 11:16:39	2004-10-17 22:20:40	Healthy	6	10600	31649	0
Fuji.2	2004-02-16 11:16:39	2004-10-17 22:20:40	Healthy	56	1304	44937	0

The statistics data for each exchange has the following information:

Exchange – the name of the exchange as it is stored in the EGD configuration server.

Configuration Time – the date and time that the configuration for the exchange was created.

Due Time – the date and time that a sample is due. For a produced exchange, this is the time that the next sample will be produced. For a consumed exchange, this is the time at which the exchange will time out if data is not received.

Status – information about the status of the exchange. For a produced exchange, status will be Producing if the exchange is actively being sent to the network and Pending if the exchange is defined but not producing. A Pending status may indicate that the controller has its I/O disabled thus stopping the production of EGD. For a consumed exchange, status will be Healthy if no timeout has occurred for the exchange and Unhealthy if the exchange is timed out.

Length – the byte size of the data for the exchange.

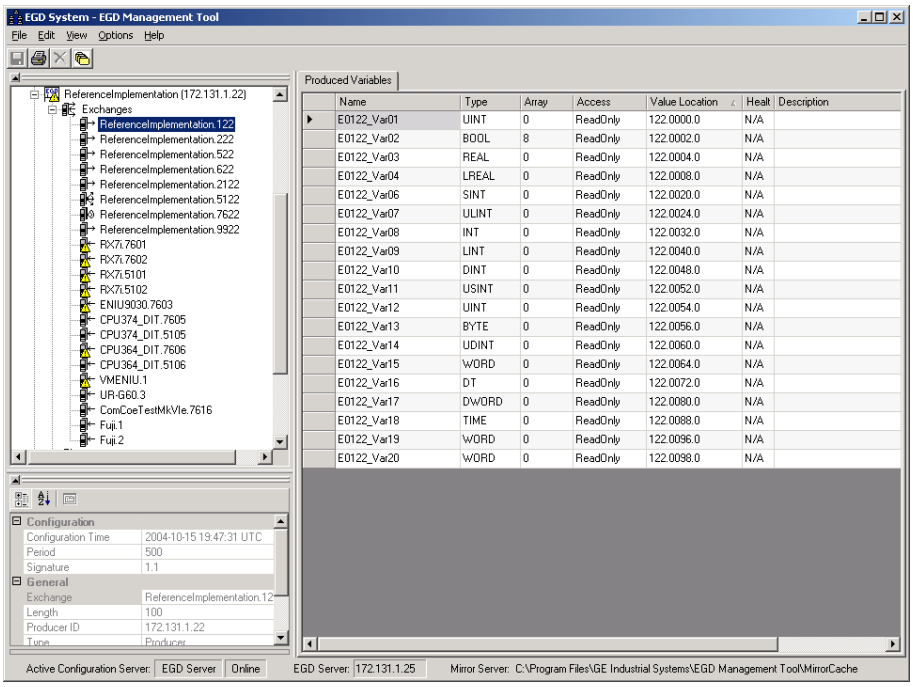
Message Count – the number of samples transferred on the exchange.

Missed Count – the number of samples that were missed on the exchange. Missed samples may indicate issues with the underlying Ethernet network or overloading of the consuming device.

Refresh Errors – the number of timeouts that have occurred for a consumed exchange.

Produced Variables

Expanding the Exchanges node in the navigator pane displays the list of exchanges for the device as recorded in the EGD Configuration Server. Selecting an exchange brings up a list of variables for that exchange as shown below. This can be used to look at the details of the data for an exchange.



Troubleshooting Common Ethernet Difficulties

Some common Ethernet errors are described below. Ethernet errors are generally indicated in the PLC Fault Table and the Ethernet exception log. As previously explained, PLC Faults generated by the Ethernet interface contain Ethernet exception events within the extra fault data. See the *TCP/IP Communications for Series 90-30 CPU374 PLUS Station Manager Manual*, GFK-2383, for detailed descriptions of Ethernet exception events.

COMMREQ Fault Errors

When the PLC CPU attempts to initiate COMMREQs to the Ethernet interface more rapidly than the Ethernet interface can accept them, the COMMREQ delivery will fail. The fault output of the COMMREQ function block will be set and the COMMREQ will not be delivered to the Ethernet interface. In this case, the PLC logic program should attempt to initiate the COMMREQ on another sweep after a very short delay. This condition may arise when the logic Program attempts to initiate greater than 16 COMMREQs in the same logic sweep.

Sustained heavy COMMREQ delivery from the PLC CPU to the Ethernet interface can use a considerable portion of the Ethernet interface's processing capability. Under heavy COMMREQ load, the Ethernet interface may discard some received COMMREQs until it is once again able to process further COMMREQs. In such cases, the Ethernet interface increments the "CmrqDscd" tally; this tally is available via the TALLY C Station Manager command.

Under sustained extremely heavy COMMREQ load, the Ethernet interface may not respond to Station Manager commands and possibly some non-Programmer data communications. If this occurs, first switch the PLC CPU to STOP mode, which ceases COMMREQ delivery in order to resume normal Ethernet operation. Then modify the PLC logic application to reduce the COMMREQ traffic to a manageable level.

PLC Timeout Errors

PLC timeout errors may occur when the SRTP traffic to the Ethernet interface exceeds the PLC's ability to process the requests, or when the PLC is unable to deliver mail to the Ethernet Interface.. PLC Timeout errors will take down an SRTP Server connection; in this case, the remote SRTP client must reestablish a new SRTP connection to the Ethernet interface.

This error is indicated in the PLC Fault Table as:

"Backplane communication with PLC fault; lost request"
with exception Event = 8, Entry 2 = 8

These errors may also be accompanied by any of the following:

"Backplane communication with PLC fault; lost request"
with exception Event = 8, Entry 2 = 6; location = Ethernet Interface

"LAN system-software fault; resuming"
with exception Event = 8, Entry 2 = 16; location = Ethernet Interface

"Non-critical CPU software event"
status code (bytes 5-8) = 80 3a 00 12; location = CPU module

The PLC Timeout condition occurs when the CPU cannot process requests within a specified timeout period. The remedy is to reduce the rate of requests, or increase the processing capacity in the PLC.

Cause	Corrective Action
Heavy COMMREQ traffic.	Reduce the rate at which the logic application sends COMMREQs to the Ethernet Interface.
Heavy SRTP traffic.	Reduce the size, number, or frequency of SRTP requests at the remote SRTP client.
Long PLC sweep time.	Modify the PLC application to reduce the PLC sweep time.
PLC Communication Window set to LIMITED mode.	Change to RUN-TO-COMPLETION mode.

Note: The CPU374 *PLUS* embedded Ethernet interface uses the Controller Communications Window.

Application Timeout Errors

Application timeout errors include:

- SRTP Channel timeout errors (COMMREQ Status 0190H or 0290H at the client)
- EGD Command timeout errors (COMMREQ Status 0190H at the client)
- EGD consumed exchange refresh errors (Exchange Status 6 or 7).

Application timeout errors can happen for several reasons, including:

- Incorrect destination device address, or destination device not on the network. The communication service cannot be performed.
  Verify that the destination device address is correct and that the destination device is functioning properly. Ping the destination device to check that it is present on the network.
- The network throughput cannot keep up with the traffic generated by the application. This condition can occur when the intervening network components between the application devices cannot handle the volume of network traffic, causing network packets to be dropped.
  For SRTP, this causes TCP retransmissions; repetitive retransmissions can slow the SRTP responses enough that the client detects an application timeout error.
  For EGD, this causes samples to be dropped. If the consumer misses enough samples, it detects a consumer timeout error; when that exchange subsequently receives samples, the consumer may detect a Data with Refresh error.
  This condition typically arises when intermediate network routers or switches lack the buffering or processing capacity to handle the network load. Reduce the volume of traffic on the network, or identify and upgrade the network component(s) that are unable to handle the traffic volume. Consult you network administrator for assistance.
- The SRTP channel timeout and period include the time required to establish the TCP connection. It is important to consider the connection time when configuring these values. If more than one SRTP channel is being established and the CPU374 server has just been restarted or updated with a new hardware configuration, the channel timeout and period should be more than one second. This allows sufficient time for the high level of TCP traffic required to establish new network connections. When first establishing a channel, a channel timeout lower than one second may result in a 0190H (channel timeout) COMMREQ status and a channel period lower than one second may result in a 0290H (period expired error)

EGD Configuration Mismatch Errors

When using Ethernet Global Data, the produced exchange (defined at the producer) must agree with the consumed exchange (defined at the consumer). The consumer generates an error when the size of an exchange received from the network differs from the configured size for that consumed exchange.

This error is indicated in the PLC Fault Table as:

"LAN system-software fault; resuming"
with exception Event = 28, Entry 2 = 1d

As this error is generated each time the mismatched exchange is received, the Ethernet exception log can quickly fill up with mismatch error events.

Cause	Corrective Action
Producer and Consumer exchange definitions are of different size.	Review the conflicting exchange definitions at the producer and at the consumer. Change the incorrect exchange definition so that produced and consumed definitions are the same size.

If the consumer wishes to ignore certain portions of a consumed exchange, be sure that the length of the ignored portions is correct. The ignored portion is specified as a byte count.

Station Manager Lockout under Heavy Load

Sustained heavy EGD and/or SRTP Server load can utilize all processing resources within the Ethernet interface, effectively locking out the Station Manager function. The Station Manager appears inoperative under either local or remote operation. The Ethernet interface always gives higher priority to data communication functions than to the Station Manager. When the processing load is reduced, the Station Manager becomes operative once again.

This condition is not reported to the PLC Fault Table or Ethernet exception log.

PING Restrictions

To conserve network data buffer resources, the CPU process only one ICMP control message at a time. An ICMP Echo (ping) request that arrives while the CPU is processing another ICMP control message is discarded. When multiple remote hosts attempt to ping the CPU at the same time, some individual ping requests may be ignored depending upon the timing of the ping requests on the network.

The CPU may initiate ping requests to another host on the network via the "ping" Station Manager command. The ping request sequence is restricted to one remote host at a time.

Discarded ping requests are not reported to the PLC Fault Table or Ethernet exception log.

SRTP Connection Timeout

When the Ethernet interface is abruptly disconnected from a remote SRTP server (for example, by disconnecting the Ethernet cable), the underlying TCP connection attempts to re-establish communication. The SRTP connection in the Ethernet interface may remains open for approximately 3 minutes 30 seconds while TCP attempts to reconnect; during this interval, the SRTP connection is unavailable. If all the SRTP connections in the Ethernet interface are in use or otherwise unavailable, a new SRTP server connection must wait until the TCP reconnect time expires on an existing connection.

The SRTP connection timeout is normal expected behavior, and is consistent with other GE Fanuc PLC products.

Sluggish Programmer Response after Network Disruption

The network programmer attempts to use a special “privileged” SRTP server connection at the Ethernet interface in order to establish and maintain connection even under heavy load due to EGD and other SRTP connections. The Ethernet interface supported only one such privileged connection. Once established, no other privileged connections are permitted until the current privileged connection is terminated. This normally occurs when the network programmer disconnects from the target PLC.

As described above under “SRTP Connection Timeout”, when the programmer-PLC network connection is abruptly broken (not the orderly termination performed during disconnection), the SRTP server connection and its underlying TCP connection remain alive until the TCP connection eventually times out (about 3 minutes 30 seconds). If the programmer reconnects during this interval, it actually obtains a new, non-privileged connection. Under heavy load at the Ethernet iInterface, the programmer may experience sluggish response over this non-privileged connection. If this occurs, the user can manually disconnect and reconnect the programmer after the previous connection has timed out. Upon reconnection, the programmer should once again obtain the privileged connection.

EGD Command Session Conflicts

EGD Commands support only one pending EGD command from a client device to each server device. Attempts to issue a second EGD command from a client to the same server before completion of the first command will result in an error. Some examples are:

1. The logic application issues a second EGD Command COMMREQ to the same remote server, perhaps from a different location in the logic program.
2. The EGDCMD Station Manager command issues a command to the same remote server device as the logic application.

SRTP Request Incompatibility with Existing Host Communications Toolkit Devices or Other SRTP Clients

The Advanced User Parameter (AUP) named “chct_comp” provides greater compatibility with existing Host Communication Toolkit devices. Some Host Communication Toolkit devices generate incorrectly-encoded SRTP messages. In some cases, the CPU374 *PLUS* enhanced Ethernet interface can detect and report SRTP encoding errors that were ignored by previous Series 90 Ethernet interfaces, including versions of the Series 90-30 CPU374 Ethernet interface prior to Release 12.0; these errors cause the CPU374 *PLUS* SRTP server to drop the SRTP connection to the Host Communications Toolkit device. If possible, the Host Communications Toolkit device should be upgraded so that it will generate properly-encoded SRTP messages. If the device cannot be upgraded, the “chct_comp” AUP parameter can be used to tell the Ethernet interface to ignore known SRTP errors that were not detected by previous Series 90 products. (See Appendix A for details of the “chct_comp” parameter.)

COMMREQ Flooding Can Interrupt Normal Operation

The PLC logic application program should generally wait for a response from each COMMREQ function block before activating another COMMREQ function block to the same endpoint. Extremely heavy COMMREQ delivery loading, such as activating the same COMMREQ every logic sweep, can prevent normal SRTP, Modbus, EGD, and Station Manager operation. During such loading, the Ethernet LAN LED may be frozen.

Accelerated EGD Consumption Can Interfere with EGD Production

Consumed EGD exchanges received from the network normally receive accelerated processing for increased overall EGD performance. This accelerated processing can preempt EGD production activity, possibly delaying transmission of produced exchanges to the network. Such delay varies with network loading and the volume of consumed exchanges. In applications requiring minimal produced exchange timing variability, the consumed exchange acceleration may be disabled via the “gc_accel” AUP parameter. (See appendix A for details of the “gc_accel” parameter.) Under extreme network load, accelerated processing of the incoming EGD samples may consume so much processing time that the watchdog timer for the network interface expires and the network interface is reset.

Appendix A Configuring Advanced User Parameters

This section describes a set of internal operating parameters for the CPU374 *PLUS* Ethernet interface that can optionally be modified for an application.

- The AUP File
- Assigning an AUP File to the CPU374 *PLUS*
- Format of the Advanced User Parameters File
- Advanced User Parameter Definitions

The AUP File

Advanced User Parameters (AUPs) are internal operating parameters used by the Ethernet interface. For most applications, the default Advanced User Parameters should not be changed.

If it is necessary to modify any of these parameters, it must be done by creating an optional AUP file, using any ASCII text editor. This file must contain the names and values of only those parameters that are being changed. This user-generated AUP file is then imported into the programmer and assigned to a particular Ethernet interface.

When the entire hardware configuration is stored from the programmer to the CPU, the programmer also stores the parameters from the AUP file. The CPU delivers any assigned AUP file data to its Ethernet interface along with its configuration. AUP file data is transferred along with the rest of the hardware configuration during both download (programmer-to-CPU) and upload (CPU-to-programmer) operations. AUP file data is also included in the configuration Verify operation between programmer and CPU.

If an Ethernet interface is not configured by the programmer, its Station Manager can be used to locally modify the Advanced User Parameters for that individual module. (Setting the IP address/subnet mask via BOOTP or the “SetIP Tool” does not qualify as a programmer configuration.)

Caution

The IEEE 802.3 standard strongly discourages the manual configuration of duplex mode for a port (as would be possible using AUP.) Before manually configuring duplex mode for a port using AUP, be sure that you know the characteristics of the link partner and are aware of the consequences of your selection. In the words of the IEEE standard: "Connecting incompatible DTE/MAU combinations such as full duplex mode DTE to a half duplex MAU, or a full-duplex station (DTE or MAU) to a repeater or other half duplex network, can lead to severe network performance degradation, increased collisions, late collisions, CRC errors, and undetected data corruption."

Note: If the speed and duplex mode of a port are forced using Advanced User Parameters, the switch will no longer perform automatic cable detection. This means that if you have the switch port connected to a switch or hub port you must use a crossover cable. If you have the switch port connected to the uplink port on a switch or hub or if you have the switch port connected to another Ethernet device you must use a normal cable.

Assigning an AUP File to the CPU374 PLUS

At the Machine Edition programmer, follow these steps to assign an AUP file to the CPU374 *PLUS* Ethernet interface:

1. In the Project tab of the Navigator window, expand the desired target PLC device.
2. Right-click on the Hardware Configuration for the target PLC, then select “Add AUP File…”.
3. In the resulting dialog box, navigate to the desired AUP file for the CPU374 *PLUS* Ethernet interface. (For the CPU374 *PLUS*, the AUP file must be named “aup_0_1.apf”.). Click “Open”.

   The specified AUP file is added to the AUP Files folder under Supplemental Files for the PLC target.

To easily edit an AUP file that has been assigned to a target, expand the Supplemental Files folder for the PLC target, then double click the AUP Files folder. The AUP Files folder opens, showing any AUP file for this target. You can now edit the AUP file with any ASCII text editor, such as Notepad.

Format of the Advanced User Parameters File

The AUP file must have this format:

AUP_***r_s***

*where **r** and **s** indicate the Rack and Slot location of the Ethernet Interface*

<parameter name> = <parameter value>
<parameter name> = <parameter value>
<parameter name> = <parameter value>

The AUP file has the following requirements:

- The first line of the file must consist only of the text: AUP_***r_s***
  where ***r*** and ***s*** usually indicate the Rack and Slot location of the Ethernet interface. For the CPU374*PLUS*, the first line of the AUP filename is always “AUP_0_1”.
- All parameter names are lowercase. The equal sign (=) is required between the parameter name and parameter value.
- Spaces are allowed, but not required, between the parameter name and the equal symbol (=) and between the equal symbol and the parameter value.
- Character string values are case-sensitive; as with Station Manager commands, uppercase parameter values must be enclosed within a pair of double quotes.
- Numeric parameters are entered in decimal or hexadecimal format; hexadecimal values must be terminated with an 'h' or 'H' character.
- IP addressing parameters must be entered in standard dotted decimal format.
- Comments in the file must start with a semicolon character. All characters in the same line following a semicolon are ignored.
- Blank lines are ignored.

Example:

The following example sets the station manager password to “system” and the IP time-to-live for point-to-point Ethernet Global Data exchanges to 4.

```
AUP_0_1
stpasswd  =  “system”     ;        set the password to “system”
gucast_ttl=4              ;        set the EGD unicast IP TTL to 4
```

Advanced User Parameter Definitions

The following Advanced User Parameters can be configured for the Ethernet interface.

System Memory Parameters (task b)		***Default***	***Range***
staudp	Remote command UDP port	18245 (4745H)	0 – 65535 (ffffH)
stpasswd	Station Manager password (only visible from MODIFY prompt)	"system"	0-8 characters, case sensitive, no spaces
Backplane Driver Parameters (task c)		***Default***	***Range***
crsp_tout	CPU response timeout. Amount of time to wait for the CPU to respond to a request sent through the PLC Driver.	60 seconds	10 – 3600 (E10H)
chct_comp	HCT compatibility option. Allows Ethernet interface to ignore SRTP header errors (typically generated by remote HCT devices) that were not detected in previous Series 90 products. 0 = HCT compatibility disabled (= report all errors) 1 = HCT compatibility enabled (= ignore some errors)	0 (0H)	0, 1
RDS Parameters (task d)		None	None
ARP Parameters (task f)		***Default***	***Range***
fflush	Interval in seconds at which to flush the ARP cache	600 (10 minutes)	0 – 604800 (93A80H)
Ethernet Global Data Parameters (task g)		***Default***	***Range***
gctl_port	UDP port for EGD control messages	7937 (1f01H)	0 – 65535 (ffffH)
gdata_port	UDP port for point-to-point (unicast) EGD messages	18246 (4746H)	0 – 65535 (ffffH)
gbcast_ttl	IP time-to-live for global broadcast messages (hop count)	1 (1H)	0 – 255 (00ffH)
gucast_ttl	IP time-to-live for point-to-point (unicast) messages (hop count)	16 (10H)	0 – 255 (00ffH)
gp_phase	Startup delay time in ms for successive produced exchanges	0 (0H)	0 – 65535 (ffffH)
gcmd_pri	EGD command processing priority. 0 = EGD commands have lower priority than data production. 1 = EGD commands and data production have equal priority. 2 = EGD commands have higher priority.	0 (0H)	0, 1, 2
gc_accel	Enable consumed exchange acceleration. 0= Acceleration disabled; 1= Acceleration enabled.	1 (1H)	0, 1
EGD provides a UDP port parameter and host group IP address parameter for each of 32 possible host groups (0-31). The parameter formats for each host group are shown below. XX specifies host group 0-31.			
gXX_udp	UDP port for host group XX	18246 (4746H)	0 – 65535 (ffffH)
gXX_addr	IP time-to-live for host group XX (must be Class D address)	224.0.7.XX	224.0.0.2 – 239.255.255.255
gXX_ttl	IP time-to-live for host group (multicast) messages (hop count)	1 (1H)	0 – 255 (00ffH)

RDS Parameters (task d)		None	None
SRTP Client (Channels) Parameters (task h)		***Default***	***Range***
hconn_tout	TCP Connect timeout (in milliseconds)	75000 (124F8H)	10 – 75000 (124F8H)
IP Parameters (task i)		***Default***	***Range***
ittl	IP header default time–to–live (hop count)	64 (0040H)	0 – 255 (00ffH)
ifrag_tmr	IP fragment timeout interval in seconds	3 (0003H)	0 – 65535 (ffffH)
ICMP/IGMP Parameters (task j)		None	None
Network Interface Parameters (task l)		***Default***	***Range***
lduplex0	Ethernet duplex for Controller (1 = half, 2= full)	2	0,1,2
lduplex1a	Ethernet duplex for Port 1A (0=auto-detect, 1=half, 2=full)	0	0,1,2
lduplex1b	Ethernet duplex for Port 1B (0=auto-detect, 1=half, 2=full)	0	0,1,2
lspeed0	Ethernet speed for Controller (1=10Mbit, 2=100Mbit)	2	0,1,2
lspeed1a	Ethernet speed for Port 1A (0=auto-detect, 1=10Mbit, 2=100Mbit)	0	0,1,2
lspeed1b	Ethernet speed for Port 1B (0=auto-detect, 1=10Mbit, 2=100Mbit)	0	0,1,2
UDP Parameters (task u)		None	None
SRTP Parameters (task v)		None	None
TCP Parameters (task w)		***Default***	***Range***
wnodelay	TCP nodelay option (0= inactive; 1 = active)	0 (000H)	0, 1
wkal_idle	TCP keepalive timer value (in seconds)	240 (4.0 min)	0 – 65535 (ffffH)
wkal_cnt	TCP keepalive probe count	2	0 – 65535 (ffffH)
wkal_intvl	TCP keepalive probe interval (in seconds)	60 seconds	0 – 65535 (ffffH)
wsnd_buf	TCP send buffer size (in bytes)	65535 (ffffH)	0 – 65535 (ffffH)
wrcv_buf	TCP receive buffer size (in bytes)	4096 (1000H)	0 – 32767 (7fffH)
FTP Parameters (task t)		***Default***	***Range***
tpassword	Password for login for FTP access.	“system”	0 to 8 characters

A

Abort Channel command (2001), 6-20
Aborting a channel, 6-2
Adapter Name, 3-19
Advanced User Parameters, A-2
Application Timeout, 9-31
AUP file, A-2

B

Backup Configuration Data, 3-2
Base Path, 3-11
BOOTP, 3-5
Broadcasting Ethernet Global Data, 4-7

C

Cable
  Ethernet, 1-5
Channel Commands, 6-2
  Abort Channel (2001), 6-20
  Channel number, 6-10, 6-14, 6-18, 6-20, 6-22
  Command period, 6-10, 6-14, 6-18
  Establish Read Channel (2003), 6-9
  Establish Write Channel (2004), 6-13
  Number of repetitions, 6-10, 6-14, 6-18
  Retrieve Detailed Channel Status (2002), 6-21
  Send Information Report (2010), 6-17
  Timeout, 6-10, 6-14, 6-18
Channel Error bit, 6-4, 9-11
Channel Status, 6-3
  SRTP, 6-4
Channel Status bits, 6-4
Channel Status words, 6-21
Channels
  Aborting, 6-2
  Maximum that can be established, 6-2
  Numbers assigned, 6-10, 6-14, 6-18, 6-20, 6-22
  Re-tasking, 6-2
Client PLC, 6-13
Client/Server Capability, 1-3
Collections, 3-12
Command Block, 6-6
COMMREQ, 9-12
COMMREQ Fault Errors, 9-29
COMMREQ Format, 6-6
COMMREQ Format for Programming EGD Commands, 5-2
COMMREQ functions, maximum pending, 6-27
COMMREQ Status, 5-3, 9-13
COMMREQ Status word
  Pointer, 6-8
Communications Request, 6-6
Configuration Data, 3-2
Configuration Data Backup, 3-2
Configuration Mismatch, 9-32
Configuration Server, 3-11
Configuring Ethernet Global Data, 3-10
Configuring the Ethernet Interface, 3-7
Consumed Data Exchange Definition, 3-19
Consumed Period, 3-19
Consumed Variable, 3-20
Consumer, 4-2

D

Data Block, 6-8
  Length, 6-7
Data Transfer bit, 6-4, 9-11
Data Transfers with One Repetition, 6-27
Destination Type, 3-16
Detailed Channel Status words, 6-21, 6-23
Determining if an IP address has been used, 2-12
Documentation, 1-2

E

EGD Command Session Conflicts, 9-33, 9-34
EGD Generic Device Editor, 3-22
EGD Management Tool, 9-23
EGD Properties, 3-13
EGD Signatur
EGD Signatures, 3-14, 3-20
EGD Validation, 3-21
Embedded switches, 2-6
EOK LED, 2-5
Establish Read Channel command (2003), 6-9
Establish Write Channel command (2004), 6-13
Ethernet Global Data, 4-2
  Configuring, 3-10
  Consumed Data Exchange Definition, 3-19
  Consumer, 4-2
  Effect of PLC modes and actions on, 4-14
  Exchange, 4-3
  Exchange Status Word, 4-15
  Operation, 4-8
  Produced Data Exchange Definition, 3-15
  Producer, 4-2
  Variables, 4-4
Ethernet Parameters, 3-8
Exchange ID, 3-16, 3-19
Exchange Status Word

Ethernet Global Data, 4-15
Exchange Variables, 3-17

F

Fault table, 9-7
FTP Connect and Login, 8-8

G

Gateways, 7-4
Group ID, 3-19

H

Hardware failure, 9-5
Host Name, 3-11
Hub, 2-9

I

I/O Fault Table Viewer, 8-7
Installation, 2-3
IP address
Assignment, 3-3
Configuration, 3-8
Determining if it has been used, 2-12
Format, 7-2
Isolated network, 3-8
IP Addresses Reserved for Private Networks, 7-3
IP Addresses, Multicast, 7-3

L

Ladder programming, 6-24
LAN Interface OK bit, 6-3
LAN LED, 2-5
LED Blink Codes, 9-6
LED Operation during Restart, 2-4
LEDs, 2-11, 9-4
Local PLC, 6-13
Local Producer ID, 3-13
Local Server Cache Path, 3-11
Loopback IP Addresses, 7-3

M

Masked Write to EGD Exchange, 5-17
Multicast IP Addresses, 7-3
Multicasting Ethernet Global Data, 4-6
Multiple Gateways and Subnets, 7-5

N

Name, 3-16, 3-19
Network Address, 6-12, 6-19
Network connection, 2-8
Network Names, 3-12
Network time sync, 3-9
Number of repetitions for a Channel Command, 6-10, 6-14, 6-18

O

Offline Configuration, 3-12
Operating States, 9-4
Operational state, 9-5

P

Password, 8-9
Period for Channel Commands, 6-10, 6-14, 6-18
PING Restrictions, 9-32
Pinging the TCP/IP Interfaces on the Network, 2-12
Pinouts, 2-8
PLC Fault Table, 9-7
PLC Fault Table Viewer, 8-5
PLC Timeout Errors, 9-30
Port Connectors, 2-6
Port Settings, 2-10
Power-Up, 2-11
Power-up states, 9-4
Private Networks, IP addresses, 7-3
Produced Data Exchange Definition, 3-15
Produced Period, 3-16, 4-9
Producer, 4-2
Producer ID, 3-19
Programmer Response, 9-33

R

Read EGD Exchange command, 5-11
Read PLC Memory command, 5-4
Related documents, 1-2
Remote PLC, 6-13
Repeater, 2-9
Repetitions, number of for Channel Commands, 6-10, 6-14, 6-18
Reply Rate, 3-16
Re-tasking a channel, 6-2
Retrieve Detailed Channel Status command (2002), 6-21

S

Sample ladder program, 6-24
Send Information Report command (2010), 6-17
Send Type, 3-16
Sequencing communications requests, 6-27
Serial port configuration
  Data rate, 3-9
  Flow control, 3-9
  Parity, 3-9
Server Capability, 1-3
Server PLC, 6-13
Server Port, 3-11
Signatures, 3-14
Simple isolated network configuration, 3-8
SNTP Operation, 4-12
SNTP Timing Signals, 4-13
Software Loader, 9-5
SRTP Channel Status, 6-4
SRTP Connection Timeout, 9-33
STAT LED, 2-5
Station Manager, 1-5
Station Manager Lockout under Heavy Load, 9-32
Station Manager Port, 2-10
Status address location, 3-8
Status Bits, 9-10
Subnet Addressing and Subnet Masks, 7-5
Subnet mask, 7-5
Subnets and Multiple Gateways, 7-5
Switch, 2-9

T

Telnet, 3-6
Temporary IP Address, 3-5, 3-6
Time units for command period, 6-10, 6-14, 6-18
Timeout Period for EGD Exchange, 4-9
Timeout for Channel Commands, 6-10, 6-14, 6-18
Timestamping of Ethernet Global Data, 4-11
Troubleshooting, 9-3

U

Update Timeout, 3-19

V

VersaPro, 3-2

W

Waiting for configuration from PLC, 9-5
Waiting for IP address, 9-5
Web Page File Transfer, 8-10
Write EGD Exchange command, 5-14
Write PLC Memory command, 5-8